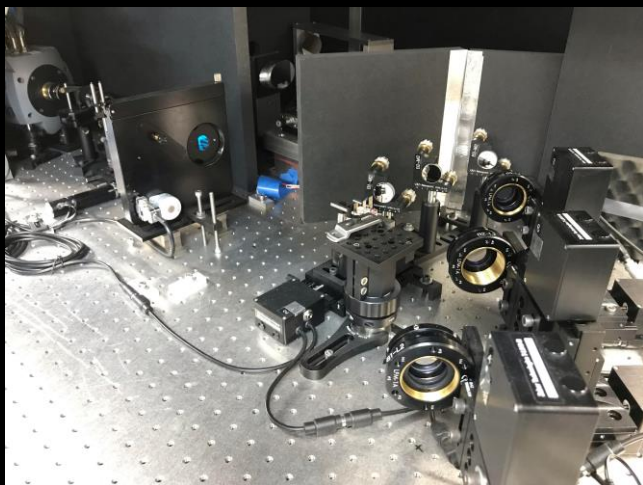


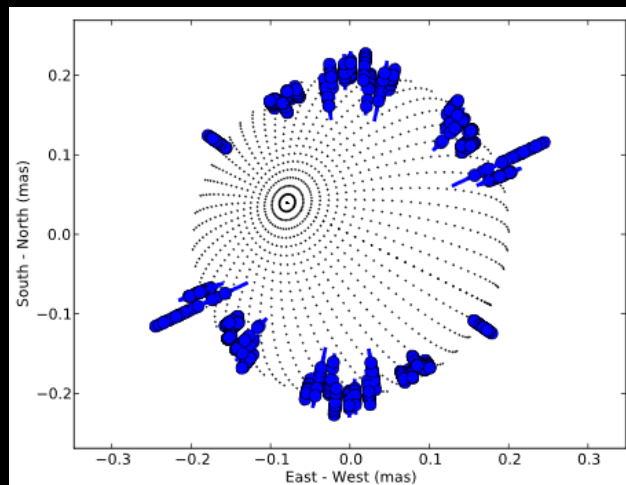
Precision Astronomical Visibility Observations (PAVO)

Jeremy Jones, CHARA Data Scientist

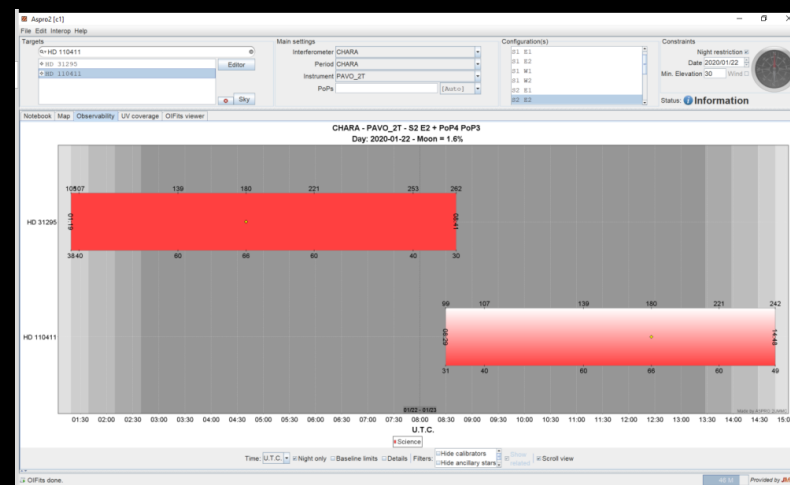
Outline



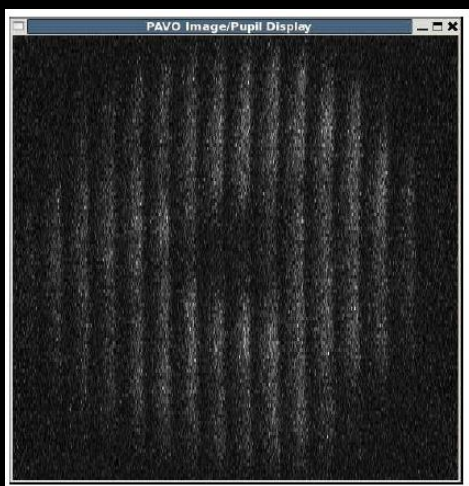
Instrument Overview



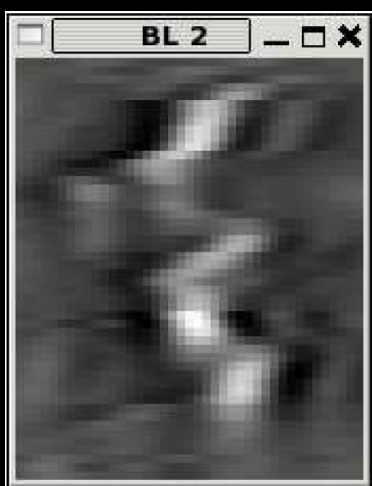
Science Overview



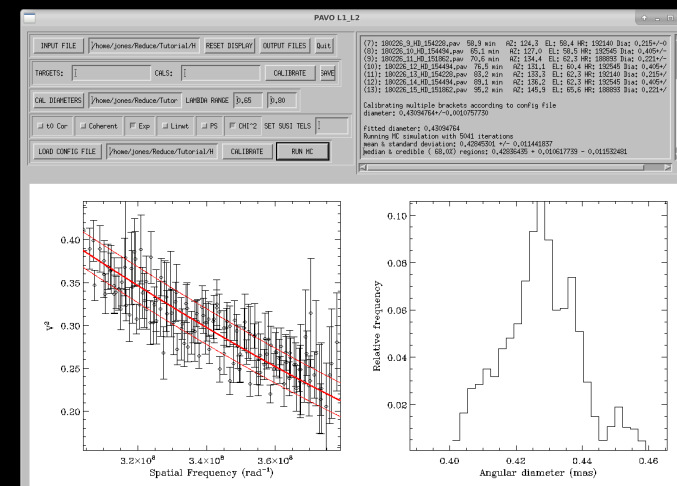
Planning



Observing

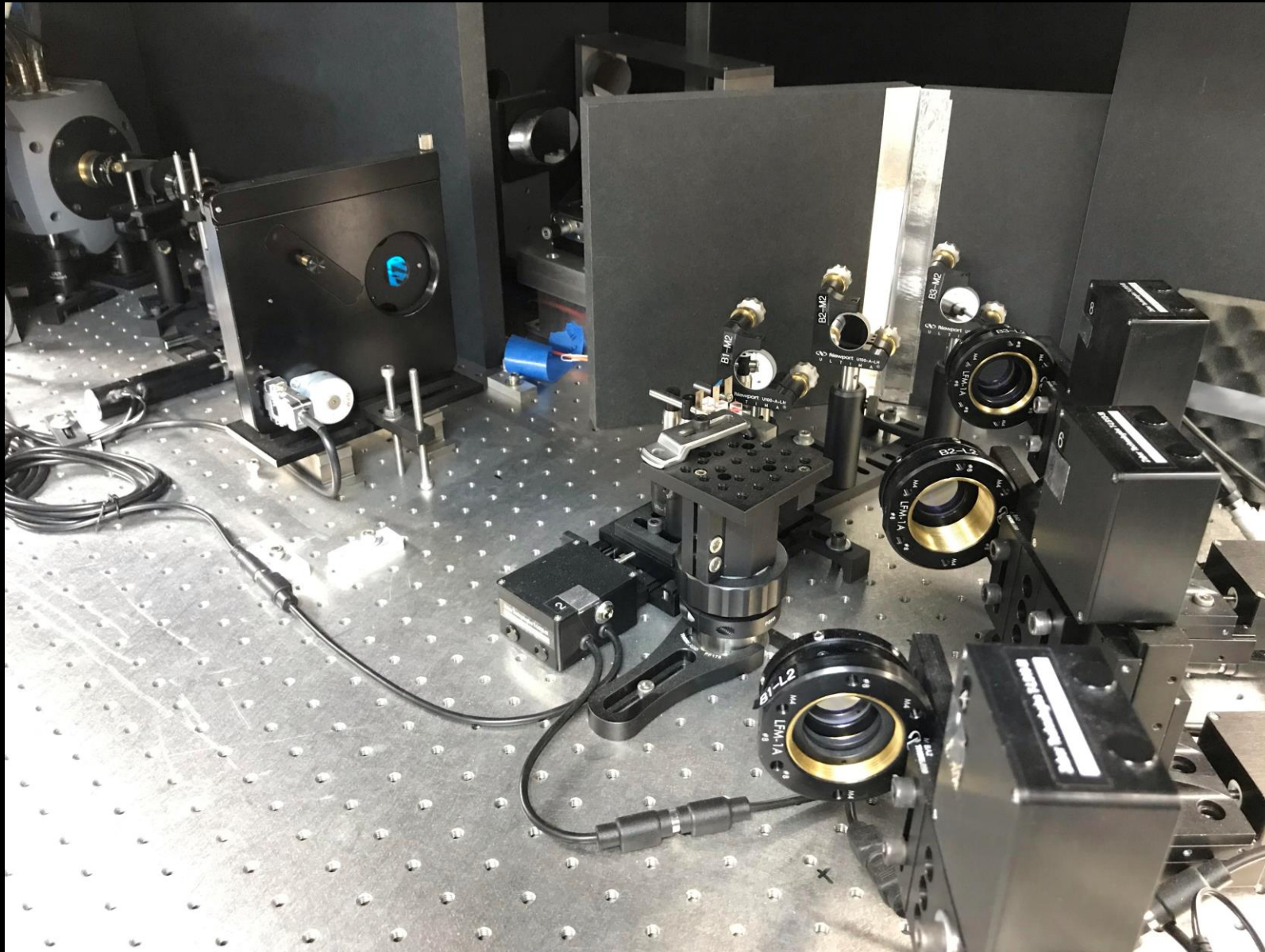


Data Reduction

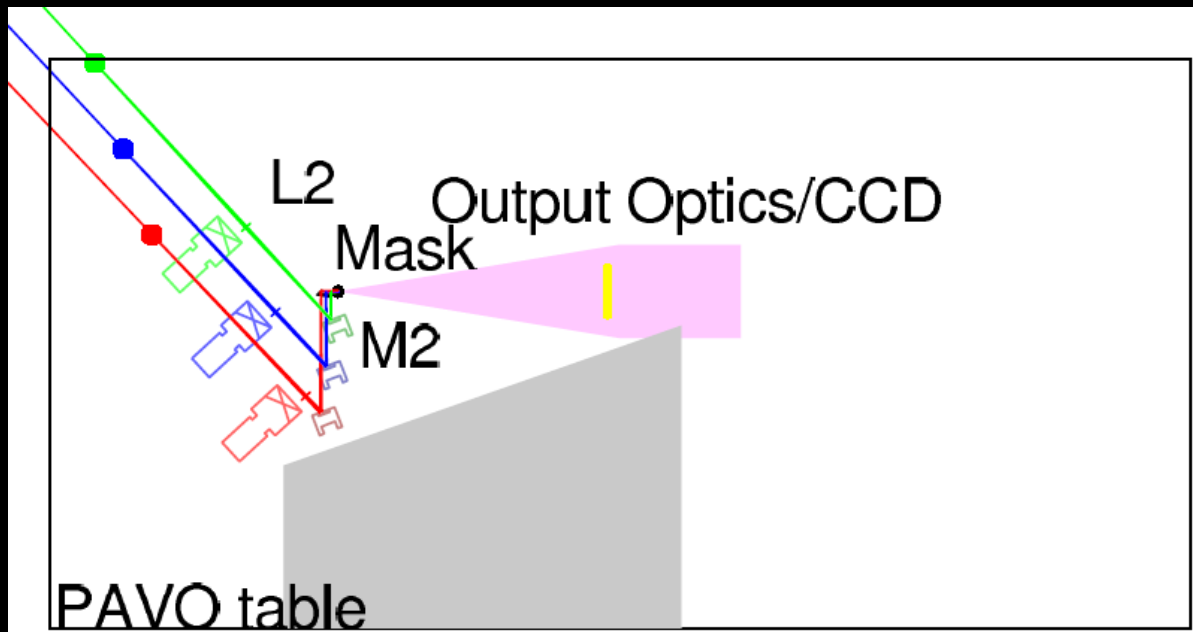


Data Calibration

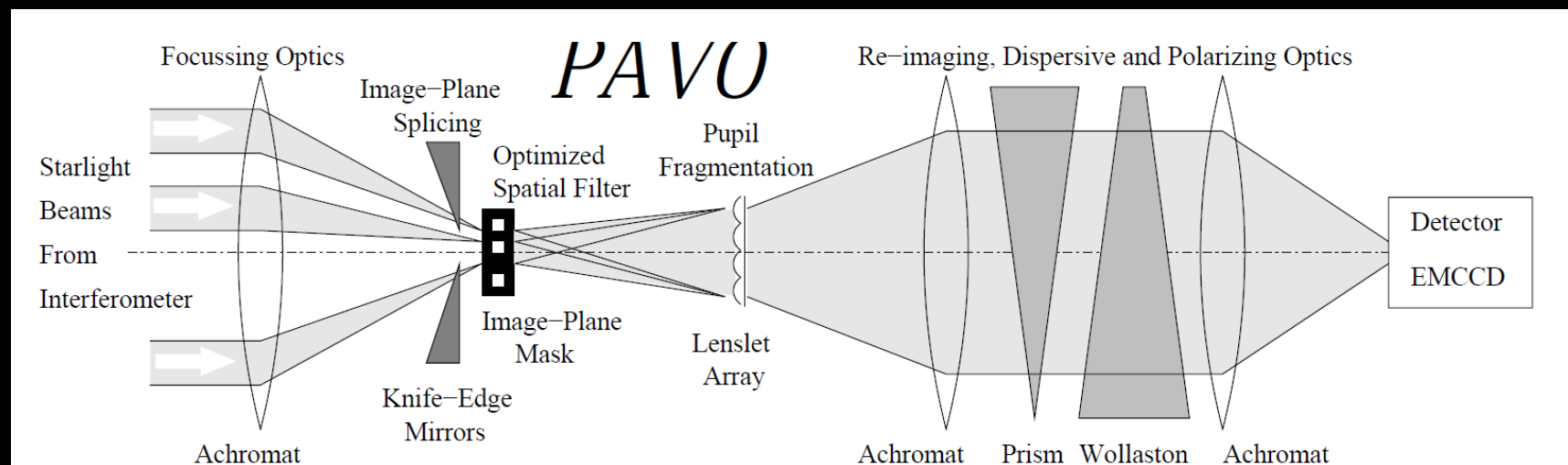
The PAVO Instrument



The PAVO Instrument



Ireland et al. 2008

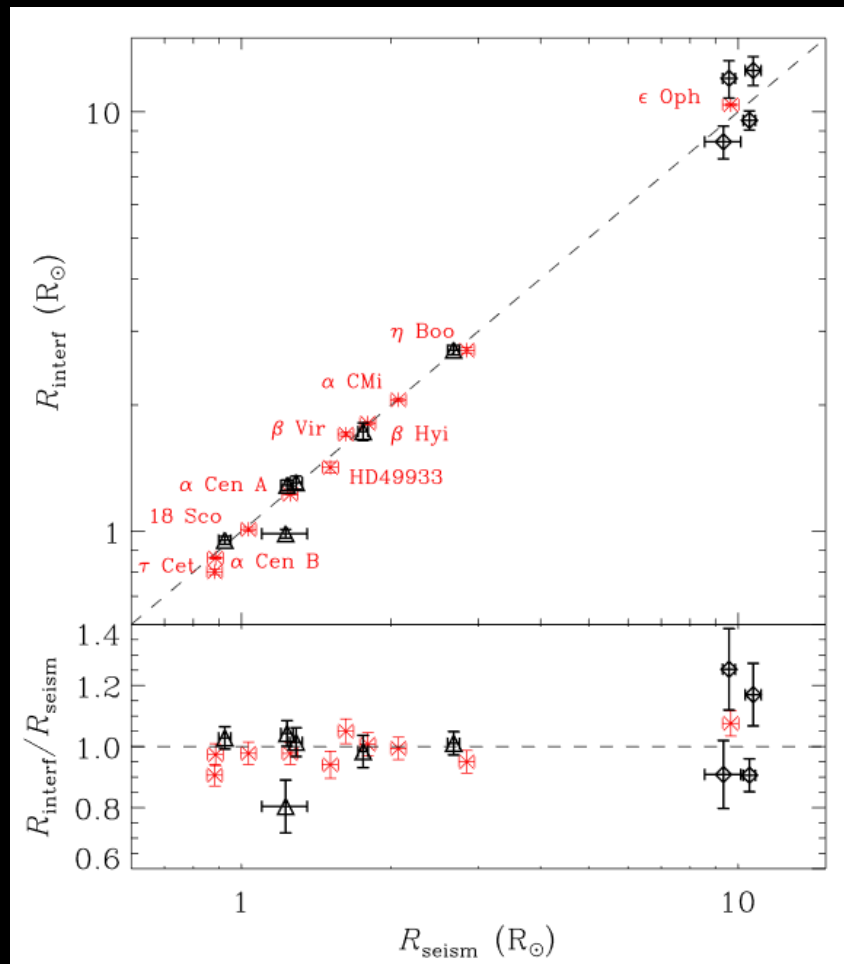


PAVO Specifications

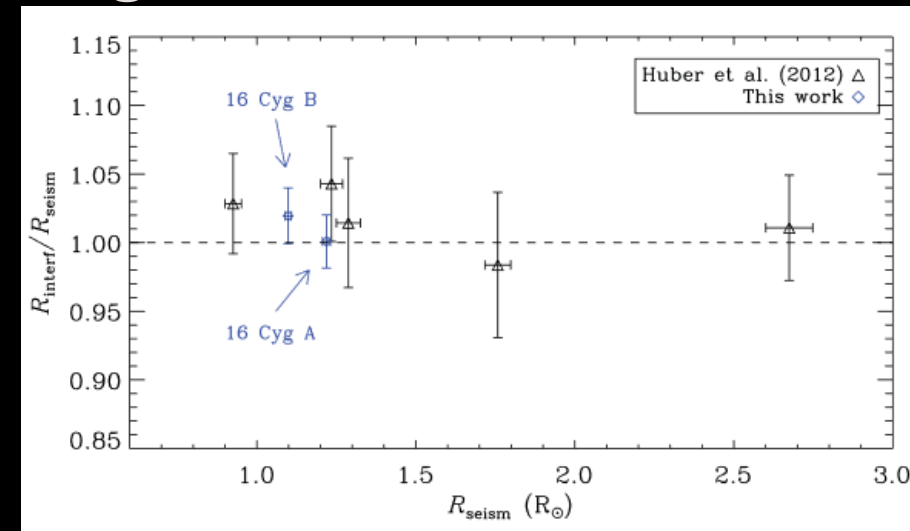
Telescopes	2
Wavelength Range	630-900 nm
Typical Limiting Magnitude	R~7 mag
Best Performance Limiting Magnitude	R~8 mag
Spectral Resolution	R=30
Spatial Resolution	0.2 mas on S1-E1 (331 m) 0.4 mas on S2-W2 (177 m)

PAVO Science Results

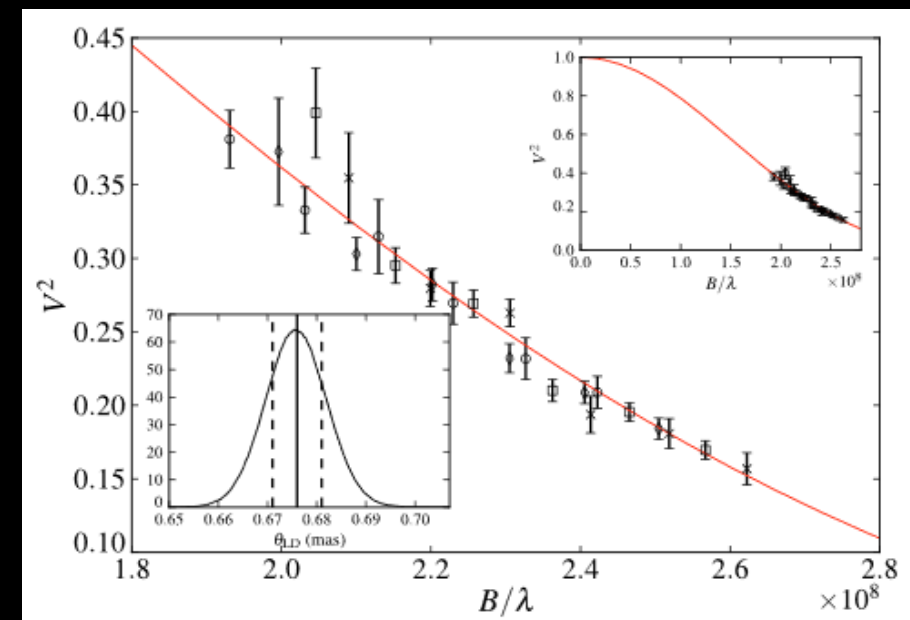
Asteroseismic Scaling Relations



Huber et al. 2012



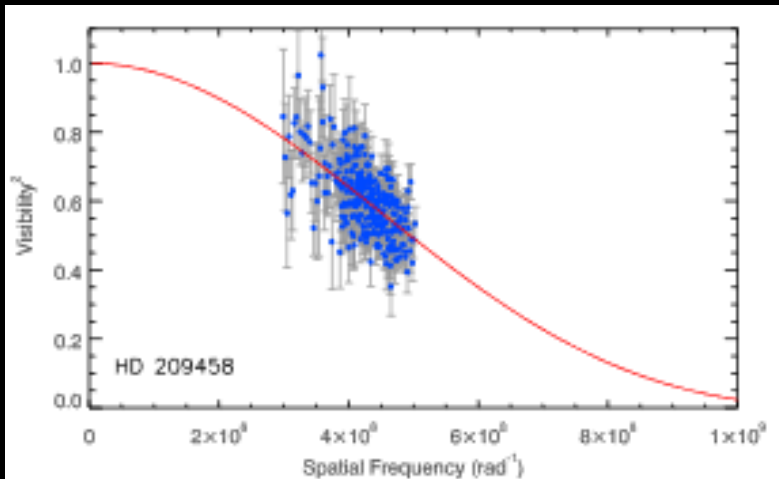
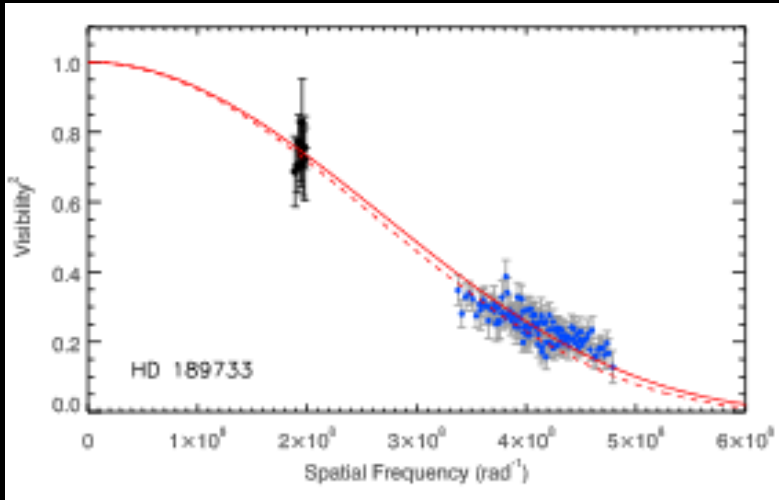
White et al.
2013



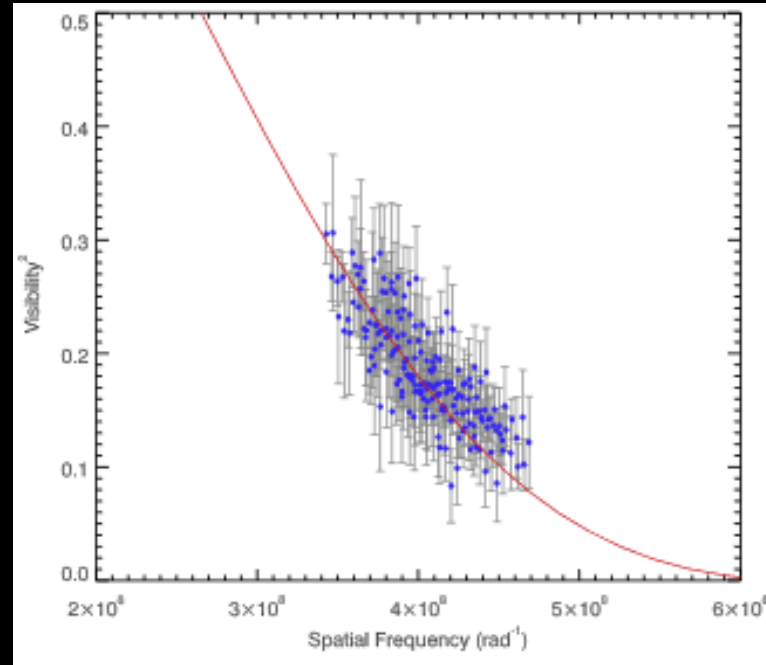
Bazot et al.
2011

PAVO Science Results

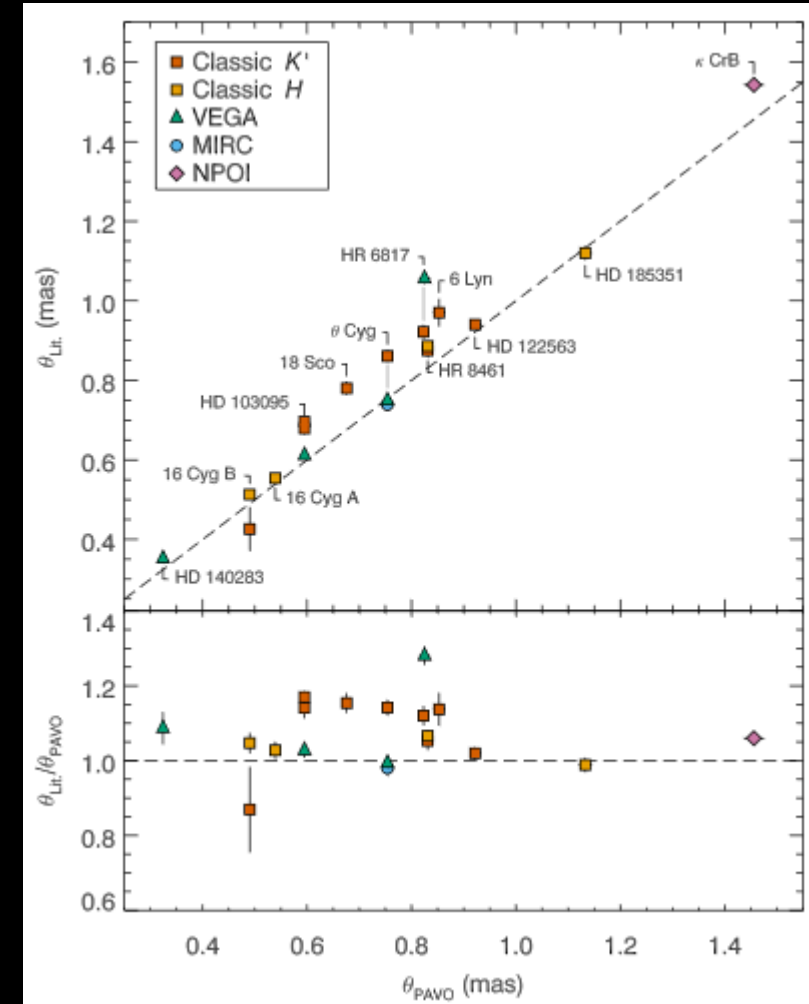
Exoplanet Host Stars



Boyajian et al. 2015



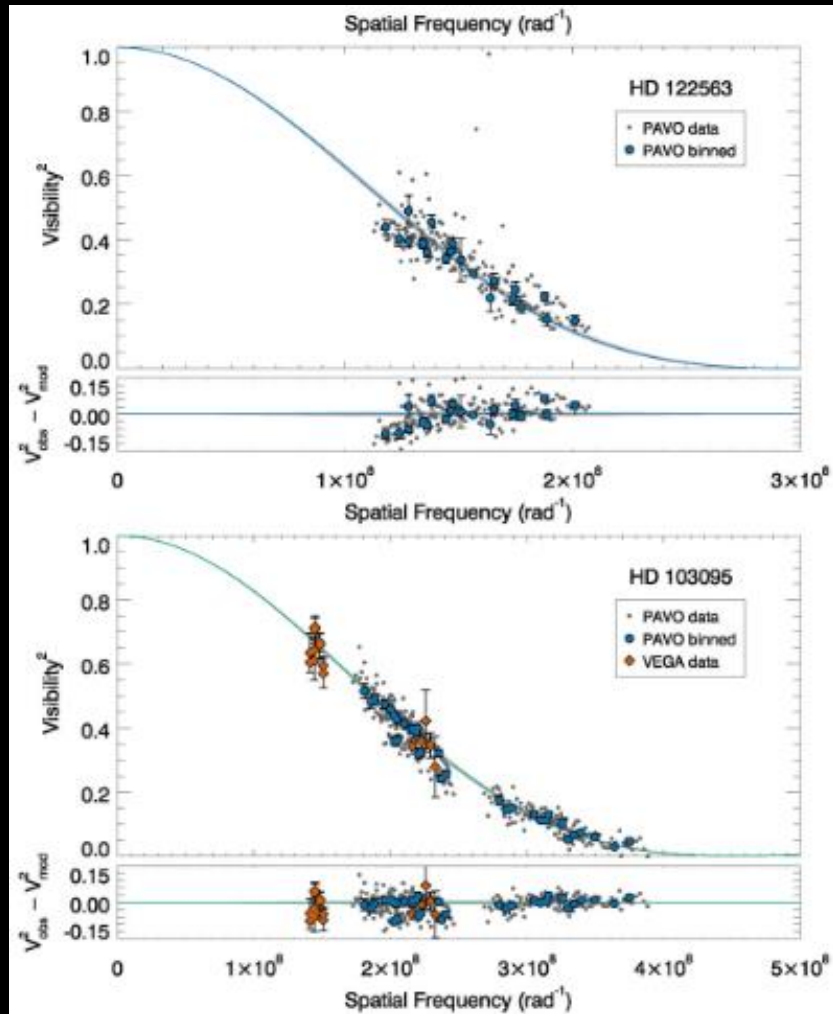
Fulton et al. 2016



White et al. 2018

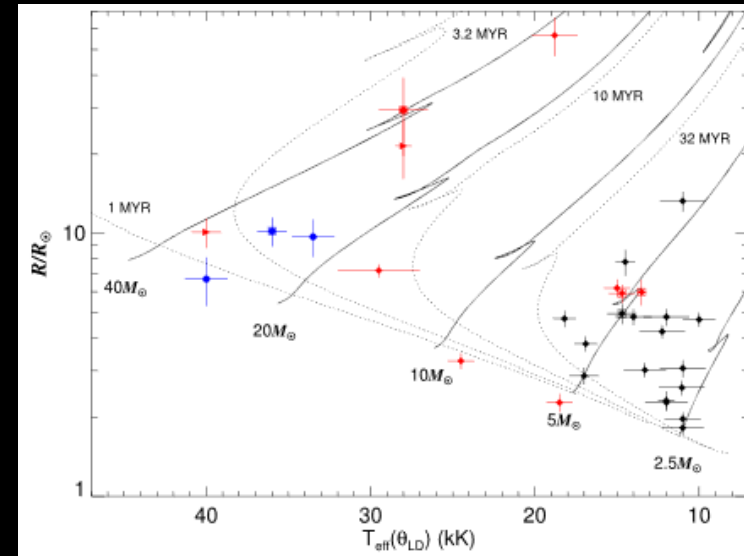
PAVO Science Results

Metal Poor Stars

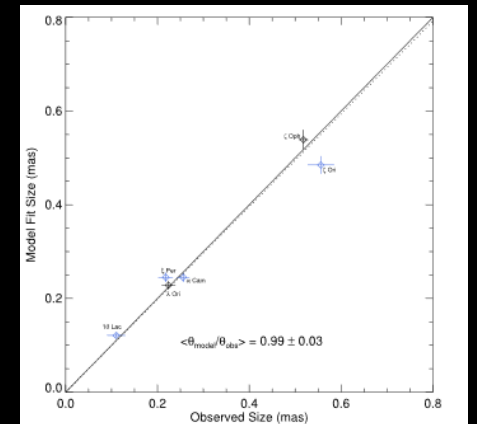
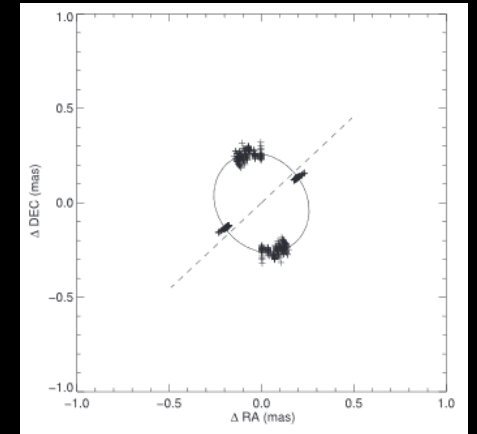


Karovicova et al. 2013

Massive O & B Stars



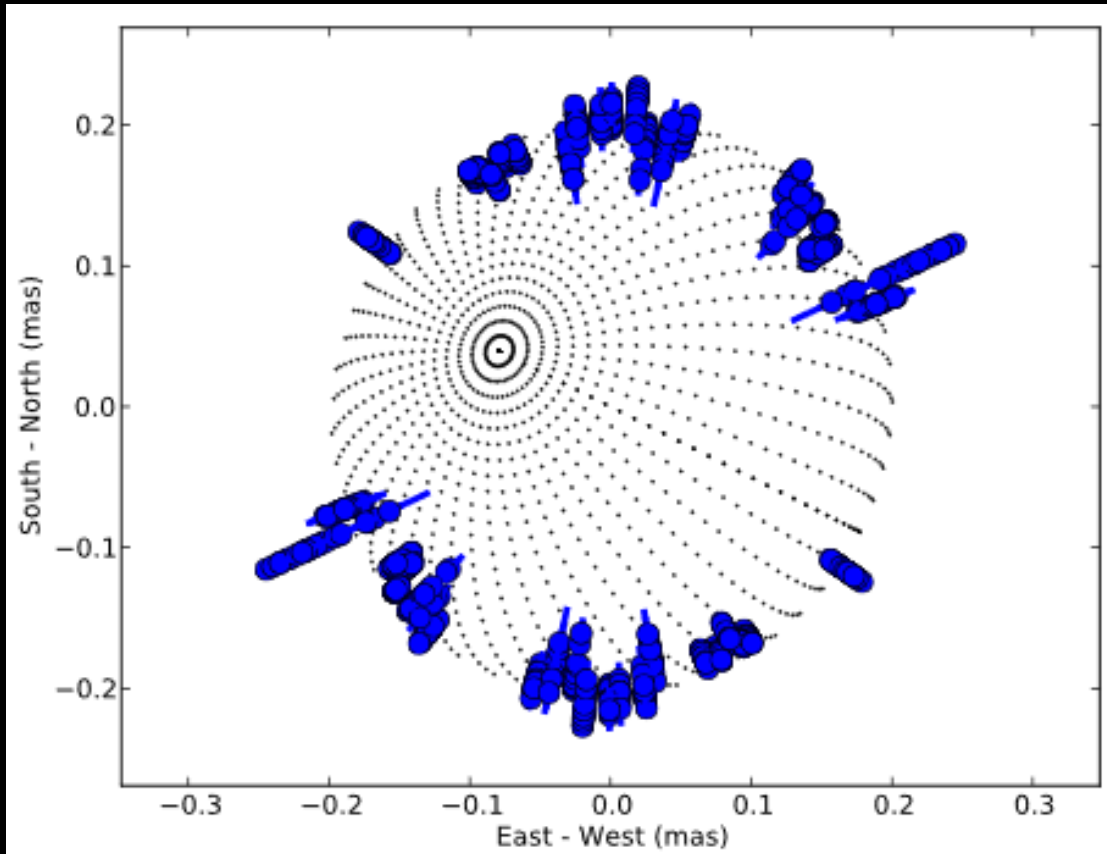
Gordon et al. 2018, 2019



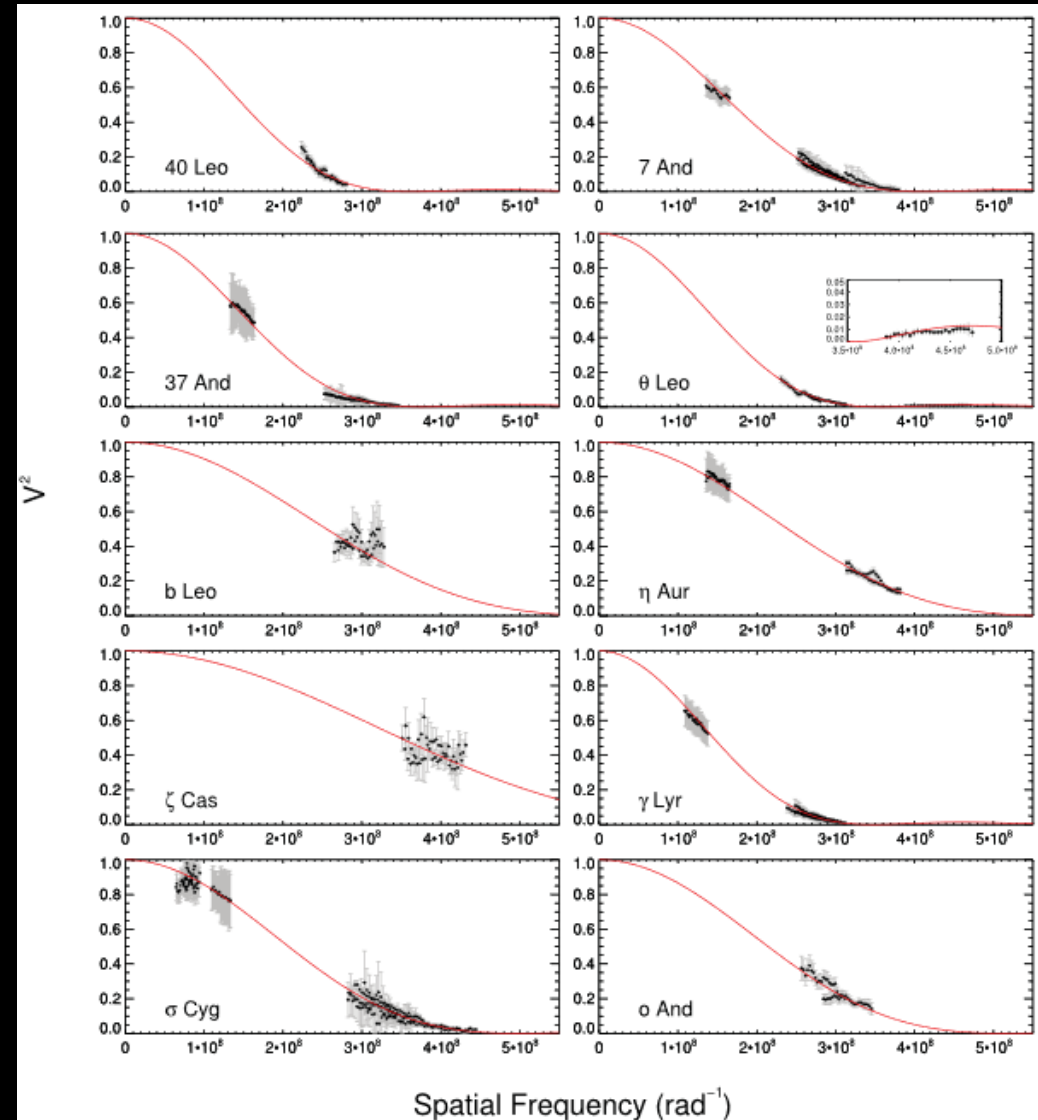
PAVO Science Results

Early Type Stars

Maestro et al. 2013

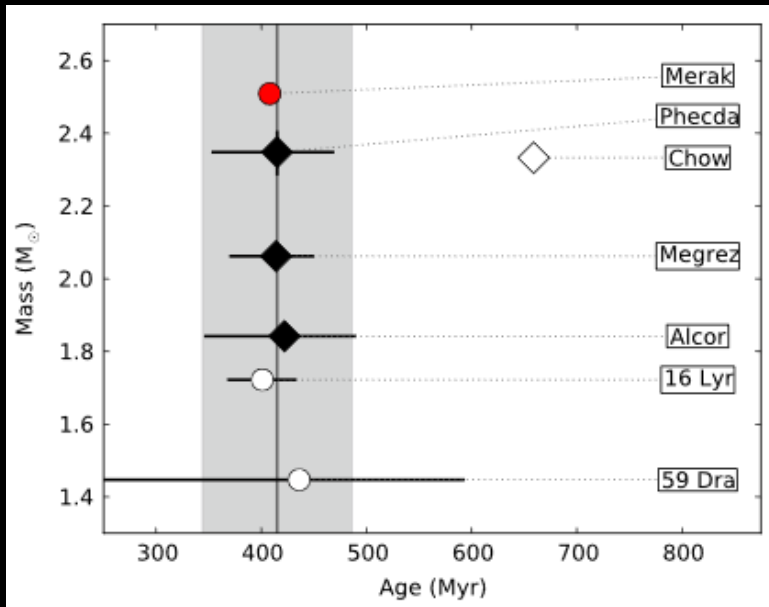


Jones et al. 2016

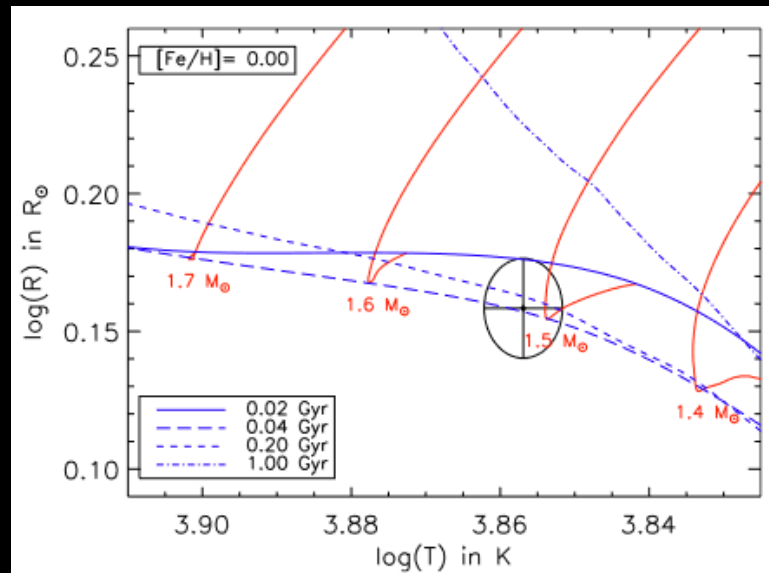
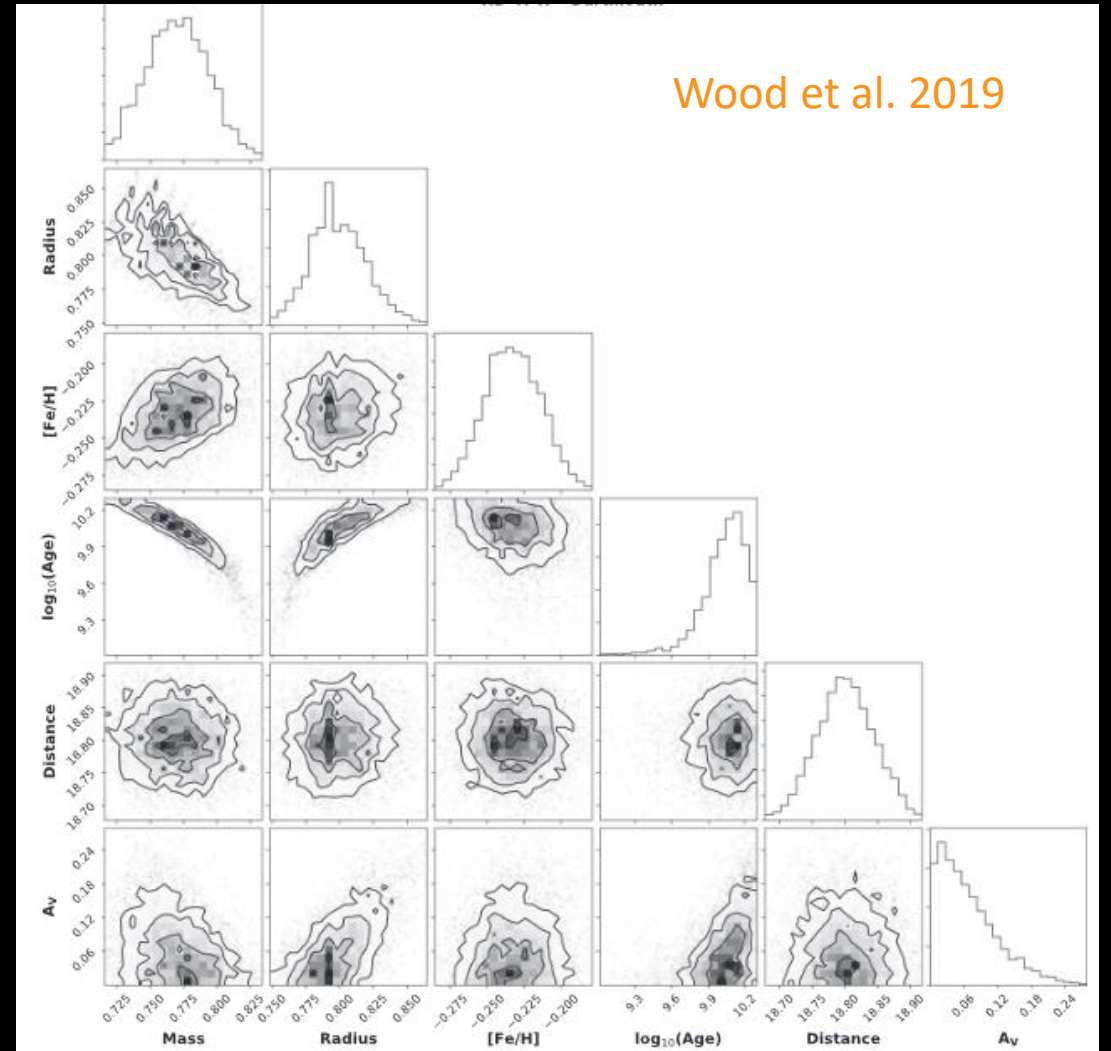


PAVO Science Results

Stellar Ages

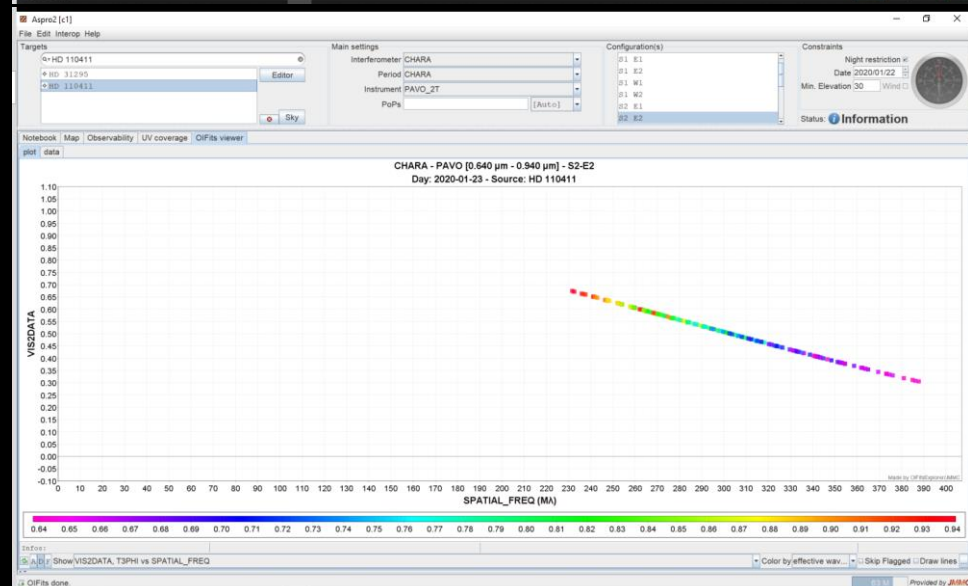
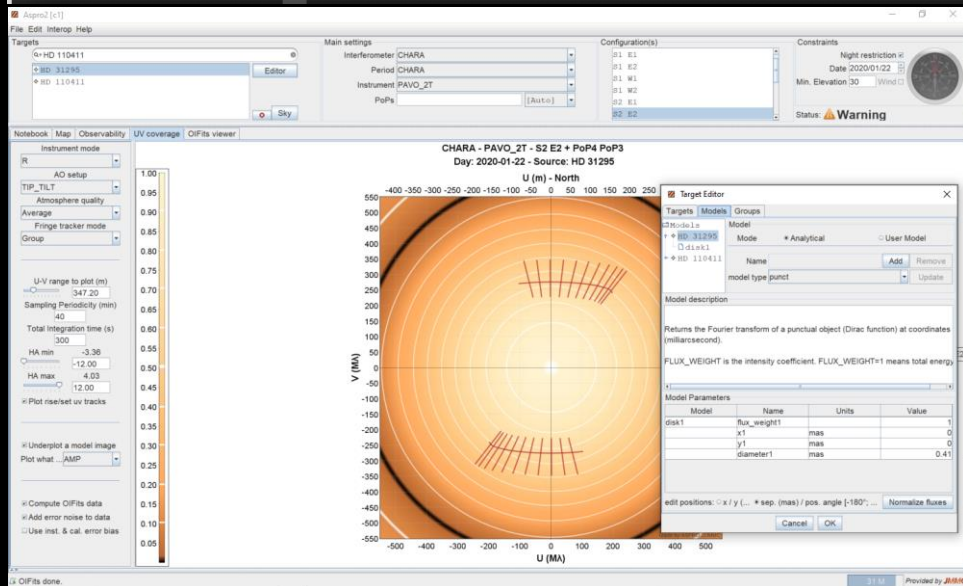
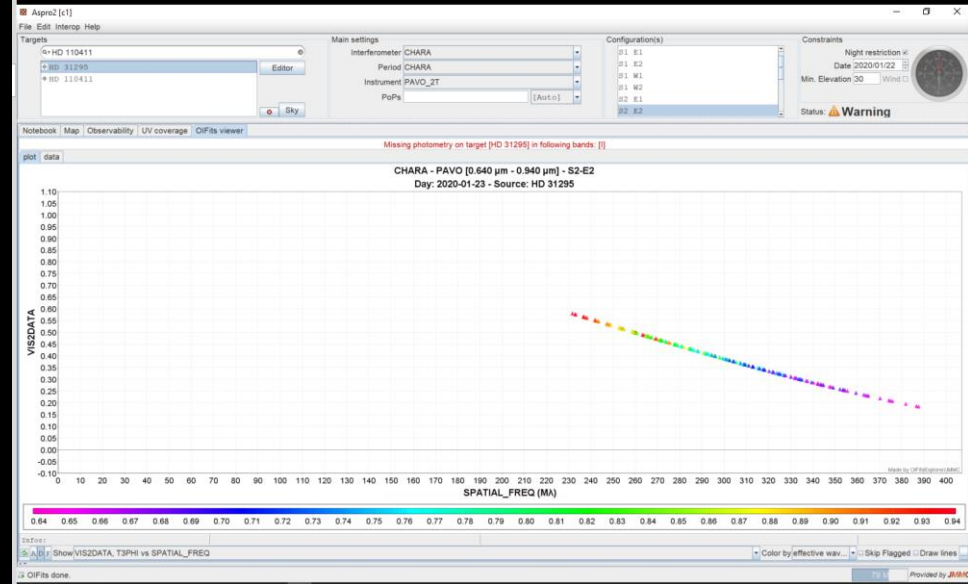
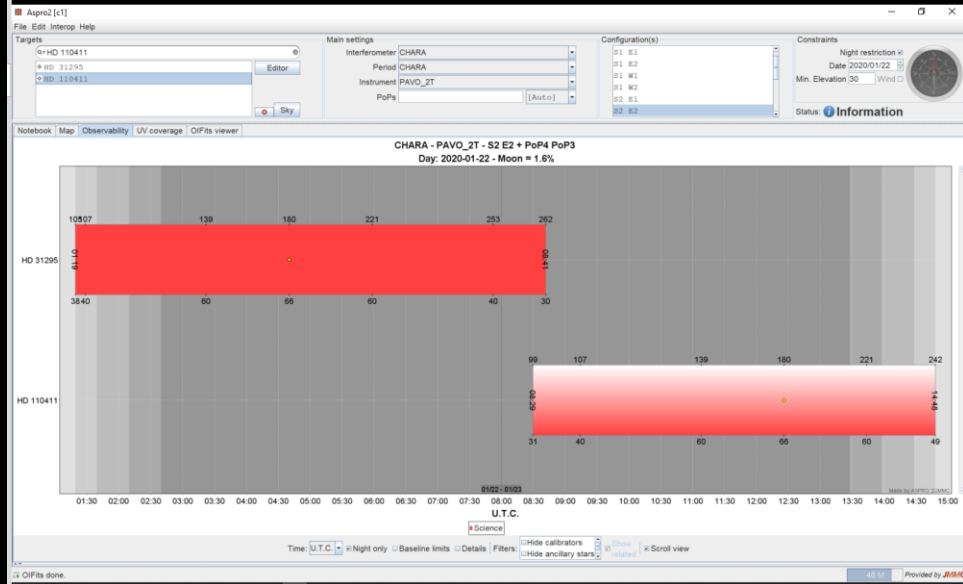


Jones et al. 2015



Baines et al. 2012

Before Observing Plan Your Observing with Aspro2



Before Observing Plan Your Observing with chara_plan2

CHARA_PLAN

UT Year : 2020 UT Month : 01 UT Day : 22

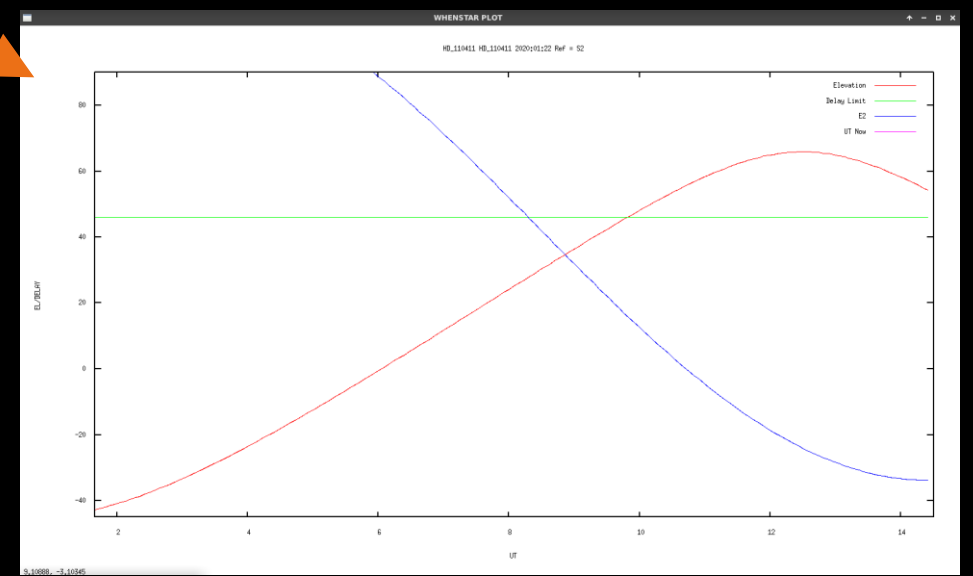
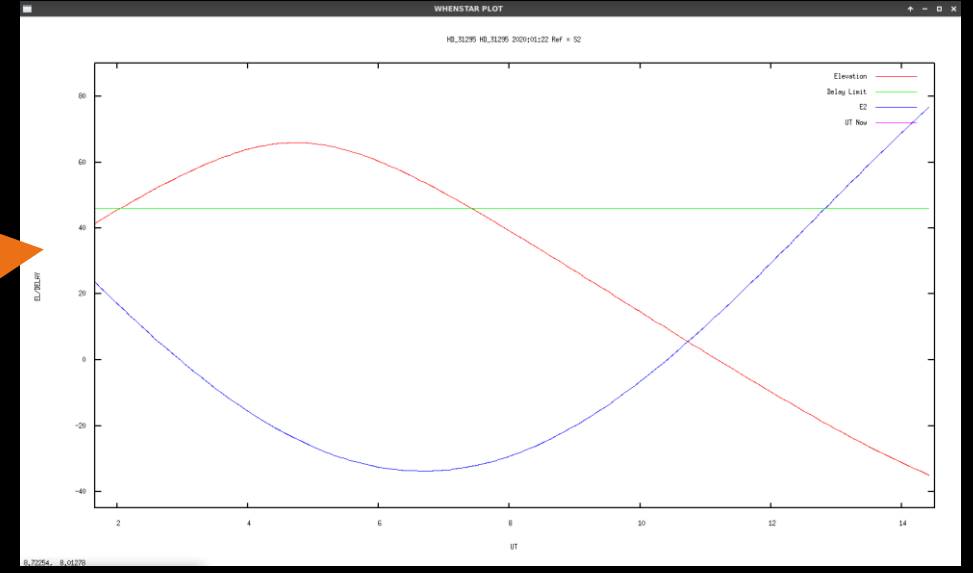
S1	POP1	BEAM1	<input type="checkbox"/>	S1	SLEW TO	CAL 1	WHEN	FIND IRC	NOT SET					
					NUM		IRC		HR		HD		SAO	
S2	POP4	BEAM1	<input checked="" type="checkbox"/>	S2	CLEAR									
E1	POP1	BEAM1	<input type="checkbox"/>	E1	SLEW TO	OBJECT	WHEN	FIND IRC	NOT SET	HD 31295				
					NUM	49700	IRC		HR	1570	HD	31295	SAO	94201
					CLEAR RA: 04 54 53.7288 DEC: +10 09 02.995 Vmag: 4.65 Kmag: 4.42 type: A0Va_IB									
E2	POP3	BEAM1	<input checked="" type="checkbox"/>	E2	SLEW TO	CAL 2	WHEN	FIND IRC	NOT SET					
W1	POP1	BEAM1	<input type="checkbox"/>	W1	CLEAR									
W2	POP1	BEAM1	<input type="checkbox"/>	W2	SLEW TO	CHECK	WHEN	FIND IRC	NOT SET	HD 110411				
					NUM	152114	IRC		HR	4828	HD	110411	SAO	100211
					CLEAR RA: 12 41 53.0566 DEC: +10 14 08.255									

Reference Cart S2

JOB QUEUE: 0 START JOB QUEUE STOP JOB QUEUE CLEAR JOB QUEUE PI: Prog:

Running job DO NOTHING.
Do Nothing.
Running job UNLINK PLOT DATA.
Searching for CHECK in data base.
CHECK: HD 110411:
CHARA 152114 HR 4828 HD 110411 SAO 100211.
RA: 12 41 53.0566 DEC: +10 14 08.255 Vmag: 4.88 Kmag: 4.68 Type: A0Va_IB
Searching for CHECK in data base.
CHECK: HD 110411:
CHARA 152114 HR 4828 HD 110411 SAO 100211.
RA: 12 41 53.0566 DEC: +10 14 08.255 Vmag: 4.88 Kmag: 4.68 Type: A0Va_IB
Data file created.
Data file plotted.
HD 110411 Above 20 degrees from 7:42 to 14:30
Transit or highest elevation at 12:31 at elevation 65.9 degrees.
Twilight from UT 01 40 00.000 to 14 30 00.000.
Delay possible 8:19 to 14:30
Whenstar calculation complete.
Running job DO NOTHING.
Do Nothing.
Running job UNLINK PLOT DATA.

BEST POPS QUIT



Before Observing

Find a Fringe Finder with pavo_ptsrc

- IDL Code
- Installed on:
 - PAVO Machine
 - Remote DR Machine
- pavo_ptsrc,'star',dist
- Find Bright Cor. Mag.
- Avoid:
 - Variables
 - Binaries
 - Rotation > 150 km/s
- Useful for:
 - Finding Fringes
 - Alignment

```
IDL> pavo_ptsrc,'HD 31295',10

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%=D%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%=D%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
Hipparcos Sources sorted by predicted diameter

Target: HD 31295

NAME  NAME  RA      DEC      Vmag  B-V   DiaBV   DiaHIP   Plx    Dist    V^2
HD    HIP    hh mm ss dd mm ss      (mag) (mag) (mas) (mas) (pc) (deg) 100m 200m 300m
-----
31331 22840  4.914086  0.467178  5.98 -0.12  0.15  0.17+/-0.02  222.2  9.68  0.98 0.90 0.0
34989 25041  5.362100  8.428564  5.78 -0.11  0.16  0.19+/-0.03  436.7  6.84  0.97 0.88 0.0
31373 22913  4.930599  15.040306  5.79 -0.09  0.17  0.19+/-0.01  111.5  4.89  0.97 0.87 0.0
29589 21735  4.667616  12.197641  5.45 -0.12  0.18  0.21+/-0.01  127.7  4.17  0.96 0.85 0.0
26793 19799  4.243400  10.011438  5.22 -0.09  0.22  0.30+/-0.01  119.9  9.92  0.94 0.78 0.0
28217 20804  4.457992  11.212332  5.87  0.05  0.23  0.22+/-0.03  180.2  6.82  0.94 0.78 0.0
34203 24555  5.267817  11.341370  5.52 -0.01  0.23  0.24+/-0.01  135.9  5.33  0.94 0.77 0.0
35149 25142  5.380556  3.544448  4.99 -0.10  0.24  0.27+/-0.07  476.2  9.58  0.93 0.75 0.0
28978 21295  4.568966  5.568635  5.67  0.05  0.25  0.24+/-0.03  148.6  6.89  0.93 0.74 0.0
35770 25555  5.462668  15.874104  5.52  0.01  0.25  0.25+/-0.01  130.0  9.84  0.93 0.73 0.0
36822 26176  5.580344  9.489586  4.39 -0.16  0.27  0.33+/-0.03  333.3  9.86  0.92 0.70 0.0
36881 26215  5.587010  10.240102  5.60  0.15  0.30  0.29+/-0.07  343.6  9.92  0.90 0.65 0.0
36267 25813  5.513069  5.948218  4.20 -0.14  0.31  0.37+/-0.02  92.9  9.83  0.89 0.63 0.0
32549 23607  5.076149  15.404181  4.65 -0.06  0.31  0.33+/-0.01  112.0  5.76  0.89 0.63 0.0
27820 20522  4.397732  9.460983  5.10  0.07  0.33  0.33+/-0.01  121.4  7.68  0.87 0.57 0.0
31237 22797  4.904193  2.440672  3.71 -0.18  0.34  0.44+/-0.07  411.5  7.71  0.87 0.56 0.0
31283 22833  4.913030  11.425974  5.18  0.12  0.35  0.34+/-0.01  70.0  1.28  0.87 0.55 0.0
30210 22157  4.767139  11.705608  5.35  0.20  0.36  0.37+/-0.01  72.2  2.67  0.86 0.52 0.0
30836 22549  4.853435  5.605102  3.68 -0.16  0.37  0.46+/-0.03  322.6  4.64  0.85 0.50 0.0
29479 21673  4.652555  15.800034  5.08  0.14  0.37  0.37+/-0.02  45.1  6.83  0.85 0.50 0.0
26912 19860  4.258902  8.892410  4.27 -0.05  0.38  0.48+/-0.02  139.7  9.79  0.84 0.49 0.0
31295 22845  4.914918  10.151145  4.64  0.09  0.42  0.41+/-0.00  35.7  0.00  0.81 0.41 0.0
36861 26207  5.585633  9.934163  3.39 -0.16  0.42  0.53+/-0.10  336.7  9.91  0.81 0.40 0.0
30739 22509  4.843534  8.900253  4.35  0.01  0.43  0.42+/-0.01  68.8  1.64  0.80 0.39 0.0
28527 21029  4.509325  16.194075  4.78  0.17  0.45  0.45+/-0.01  43.2  8.46  0.78 0.35 0.0
29488 21683  4.654570  15.918024  4.67  0.15  0.46  0.45+/-0.01  47.7  6.91  0.78 0.34 0.0
29388 21589  4.635945  12.510874  4.27  0.12  0.53  0.51+/-0.01  47.1  4.73  0.71 0.22 0.0
29140 21402  4.594232  10.160917  4.25  0.18  0.58  0.59+/-0.03  47.9  4.73  0.66 0.15 0.0
28319 20894  4.477688  15.870947  3.40  0.18  0.86  0.86+/-0.02  46.1  8.57  0.39 0.00 0.0

Cor.Mag.
100m 200m 300m
6.01 6.09 6.23
5.81 5.91 6.09
5.83 5.95 6.15
5.49 5.63 5.85
5.29 5.49 5.83
5.94 6.14 6.49
5.59 5.81 6.18
5.07 5.30 5.71
5.75 6.00 6.44
5.60 5.85 6.30
4.48 4.77 5.28
5.71 6.07 6.72
4.32 4.70 5.39
4.77 5.16 5.86
5.25 5.70 6.55
3.86 4.34 5.23
5.34 5.83 6.75
5.52 6.05 7.07
3.86 4.43 5.54
5.26 5.84 6.96
4.45 5.04 6.19
4.87 5.62 7.16
3.62 4.37 5.92
4.59 5.37 7.01
5.04 5.91 7.78
4.94 5.84 7.81
4.64 5.90 9.39
4.70 6.34 16.27
4.43 11.70 8.01

Type Binary/Var
B5V V(0),ROT=195.0
B1V... V(0),ROT=46.2
B9V V(0),ROT=83.0
B8IV V(0),ROT=70.0
B9Vn V(0),ROT=319.3
B8IV V(0),B(1, 0.6,2.0),ROT=70.0
A0V V(0),ROT=66.7
B1V V(0),B(1,31.4,2.2),ROT=250.0
A2Vs V(0),ROT=20.8
B9.5Vn V(0),ROT=266.7
B0IV... V(0),B(1, 0.1,N/A),SB(1,N/A),ROT=26.7
BIIIMnp V(0),B(1, 2.9,3.4),SB(1,N/A),ROT=22.5
B5V V(0),ROT=162.7
A0p Si V(1),ROT=34.3
A3V V(0),ROT=77.0
BIII SB V(1),SB(1,N/A),ROT=90.0
A3V V(0),B(1, 0.3,N/A),ROT=160.0
Am... V(0),B(2,38.9,7.8),ROT=56.6
BIII SB V(0),SB(1,N/A),ROT=36.2
A4m V(0),SB(1,N/A),ROT=56.5
B3IV V(0),ROT=85.0
A0V V(0),B(2,****,4.2),ROT=115.7
O... V(0),ROT=68.3
A1Vn V(0),ROT=214.0
A6IV V(0),B(1,****,1.9),ROT=75.2
A5Vn V(0),B(1,****,0.4),ROT=122.8
A6V
A5m
A7III
```

$$\text{Correlated } V_{\text{mag}} = V_{\text{mag}} - 2.5 \times \log(\text{Vis})$$

$$\text{Correlated Flux} = \text{Flux} \times \text{Vis}$$

Observing with PAVO

The PAVO Server

```
observe@pavo:~
File Edit View Terminal Tabs Help

Local Tm: 0:12 Detector T: -68.9A Status: run
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800
Saving: ON Filenum: 12810 ople: OPEN/OFF Cosmic: 4.9 +/- 27.9
Shutter: OPEN XY: -0.56 0.0 SNoFF/on: 1.2 1.8 DTIME: 0.83

Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0
E2S2 0.0 25.1 139 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22

PAVO 1.0

Current menu : MAIN
Previous menu : None
Menu Depth : 0

<?> Help
<BACKSPACE> Previous menu
<^> MAIN menu

F1 Get help
F2 Run the auto list
F3 Background control menu
F4 Socket control menu
F5 Standard Control menu
F6 Utilities Menu
F7 Quit system
```

Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A Status: run  
EM Gain: 175 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0  
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800  
Saving: ON Filenum: 12810 ople: OPEN/OFF Cosmic: 4.9 +/- 27.9  
Shutter: OPEN XY: -0.56 0.0 SNoFF/on: 1.2 1.8 DTIME: 0.83  
Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S  
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0  
E2S2 0.0 25.1 139 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22  
  
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

Local Time



Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A  
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0  
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800  
Saving: ON Filenum: 12810 ople: OPEN/OFF Cosmic: 4.9 +/- 27.9  
Shutter: OPEN XY: -0.56 0.0 SNoFF/on: 1.2 1.8 DTIME: 0.83  
Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S  
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0  
E2S2 0.0 25.1 139 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22  
  
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

Detector Temperature



Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A Status: run  
EM Gain: 173 Max: 459 Flux: 6.45e+05  
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800  
Saving: ON Filenum: 12810ple: OPEN/OFF Cosmic: 4.9 +/- 27.9  
Shutter: OPEN XY: -0.56 0.0 SNoFF/on: 1.2 1.8 DTIME: 0.83  
Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S  
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0  
E2S2 0.0 25.1 139 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22  
  
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

Flux



Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A Status: run  
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0  
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800  
Saving: ON Filenum: 128100ple ←  
Shutter: OPEN XT: -0.56 0.0 SNoFF/on: 1.2 1.8 DTIME: 0.83  
Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S  
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0  
E2S2 0.0 25.1 139 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22  
  
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

Current Saved
File Number

Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A Status: run  
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0  
Error: Debug: 0.50N Late: 1 Size: 512x228 Count: 776, 775/ 800  
Saving: ON Filenum: 12810ople: OPEN/OFF Cosmic: 4.9 +/- 27.9  
Shutter: OPEN XY: -0.56 CUSNoff/on: 1.2 1.8 RTIME: 0.02  
Bline GD S/N Tint Col V 2 V^2C Rat Disp Tel State Pos Vel TEL S  
W2E2 0.0 1.0 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0  
E2S2 0.0 25.1 139 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 519 -0.0 22  
  
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

Baselines

Telescopes and their Carts' States

- OFF – Cart off
- AOFF – Searching, Not locked
- AON – Locked!
- FIX – Reference Cart

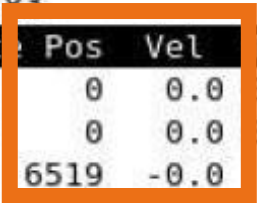
Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A Status: run  
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0  
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800  
Saving: ON Filenum: 12810ople: OPEN/OFF Cosmic: 4.9 +/- 27.9  
Shutter: OPEN XY: -0.56 0.0 SNoFF/on: 1.2 1.8 DTIME: 0.03  
Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S  
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0  
E2S2 0.0 25.1 139 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22
```

```
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

Cart Positions
and Velocities



Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A Status: run  
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0  
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800  
Saving: ON Filenum: 12810 ople: OPEN/OFF Cosmic: 4.9 +/- 27.9  
Shutter: OPEN XY: -0.56 0.0 SNoFF/on: 1.2 1.8 DTIME: 0.83  
Bline G S/N int Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S  
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0  
E2S2 0.0 25.1 159 775 0.524 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22  
  
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

Current Signal
to Noise Value

Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A Status: run  
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0  
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800  
Saving: ON Filenum: 12810ople: OPEN/OFF Cosmic: 4.9 +/- 27.9  
Shutter: OPEN XY: -0.56 0.0 SNOFF/on: 1.2 1.8 DTIME: 0.85  
Bline Gl S/N Int Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S  
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0  
E2S2 0.0 25.1 159 775 0.524 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22  
  
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

Stop Tracking
at this S/N

Start Tracking
at this S/N

Current Signal
to Noise Value

Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A Status: run  
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0  
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800  
Saving: ON Filenum: 12810ople: OPEN/OFF Cosmic: 4.9 +/- 27.9  
Shutter: OPEN XY: -0.56 0.0 SNoFF/on: 1.2 1.8 DTIME: 0.83  
Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S  
E2S2 0.0 25.1 0.0 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
S2 A0N 0.0 0.0 0.0 775 0.023 -3.196 -4.0 S2 A0N 0.0 -0.0 22  
  
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

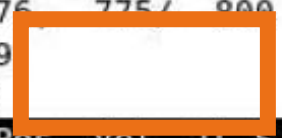
Fringes on E2-S2 with E2 as Reference

Observing with PAVO

The PAVO Server

```
observe@pavo:~  
File Edit View Terminal Tabs Help  
Local Tm: 0:12 Detector T: -68.9A Status: run  
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0  
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 775 775 / 800  
Saving: ON Filenum: 12810 ople: OPEN/OFF Cosmic: 4.9 +/- 27.9  
Shutter: OPEN XY: -0.56 0.0 SNOFF/on: 1.2 1.8 DTIME: 0.83  
Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos vet TL S  
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0  
E2S2 0.0 25.1 139 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0  
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22  
  
PAVO 1.0  
Current menu : MAIN  
Previous menu : None  
Menu Depth : 0  
  
<?> Help  
<BACKSPACE> Previous menu  
<^> MAIN menu  
  
F1 Get help  
F2 Run the auto list  
F3 Background control menu  
F4 Socket control menu  
F5 Standard Control menu  
F6 Utilities Menu  
F7 Quit system
```

New Version has
Countdown Until
Sequence End



Observing with PAVO

The PAVO GUI



Observing with PAVO

The PAVO GUI



**Starts and Stops the
PAVO Camera**

Observing with PAVO

The PAVO GUI



Manually Save
It's green when saving

Observing with PAVO

The PAVO GUI



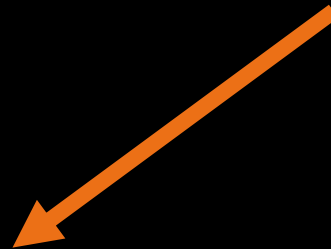
Autosave
Starts saving when fringes locked

Observing with PAVO

The PAVO GUI



Shutters – Green when open



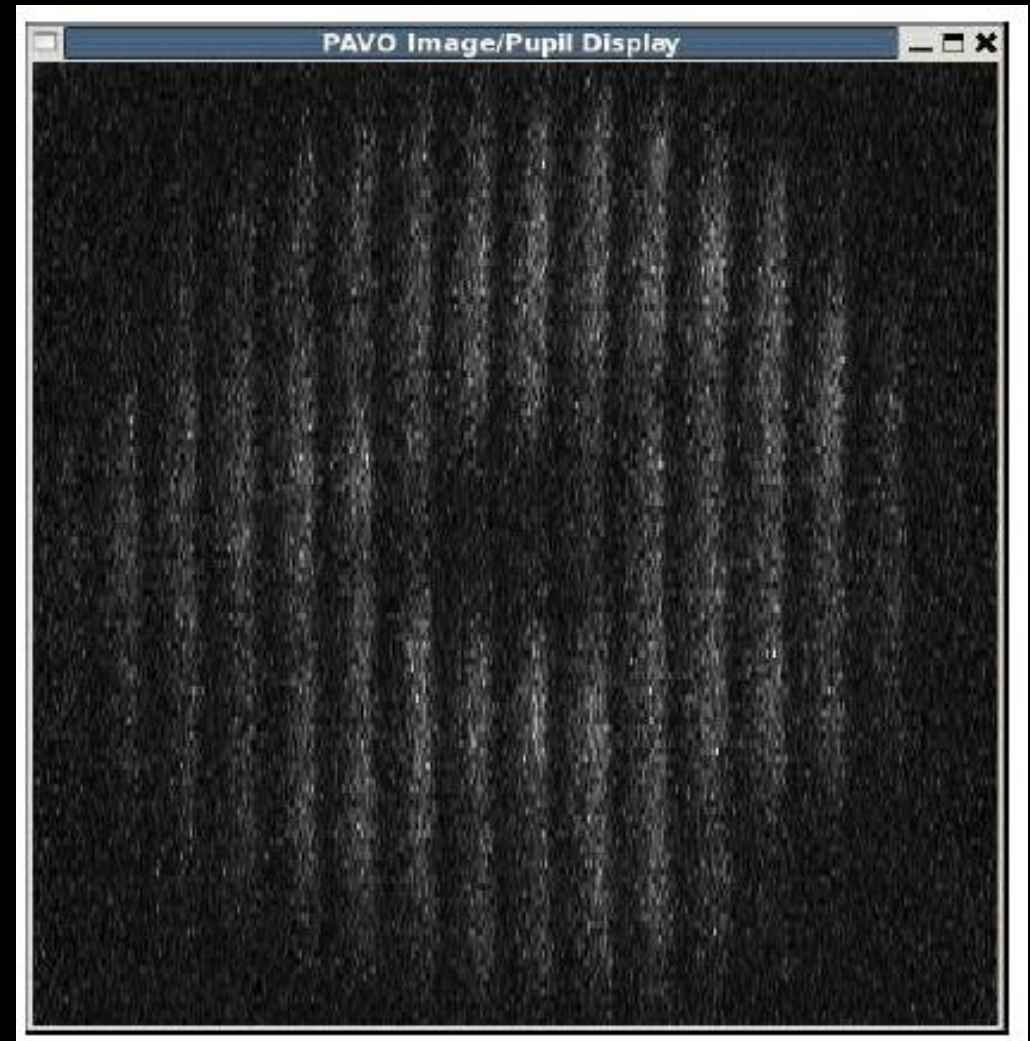
Observing with PAVO

The PAVO GUI



Lenslet View

Toggles the Display Window

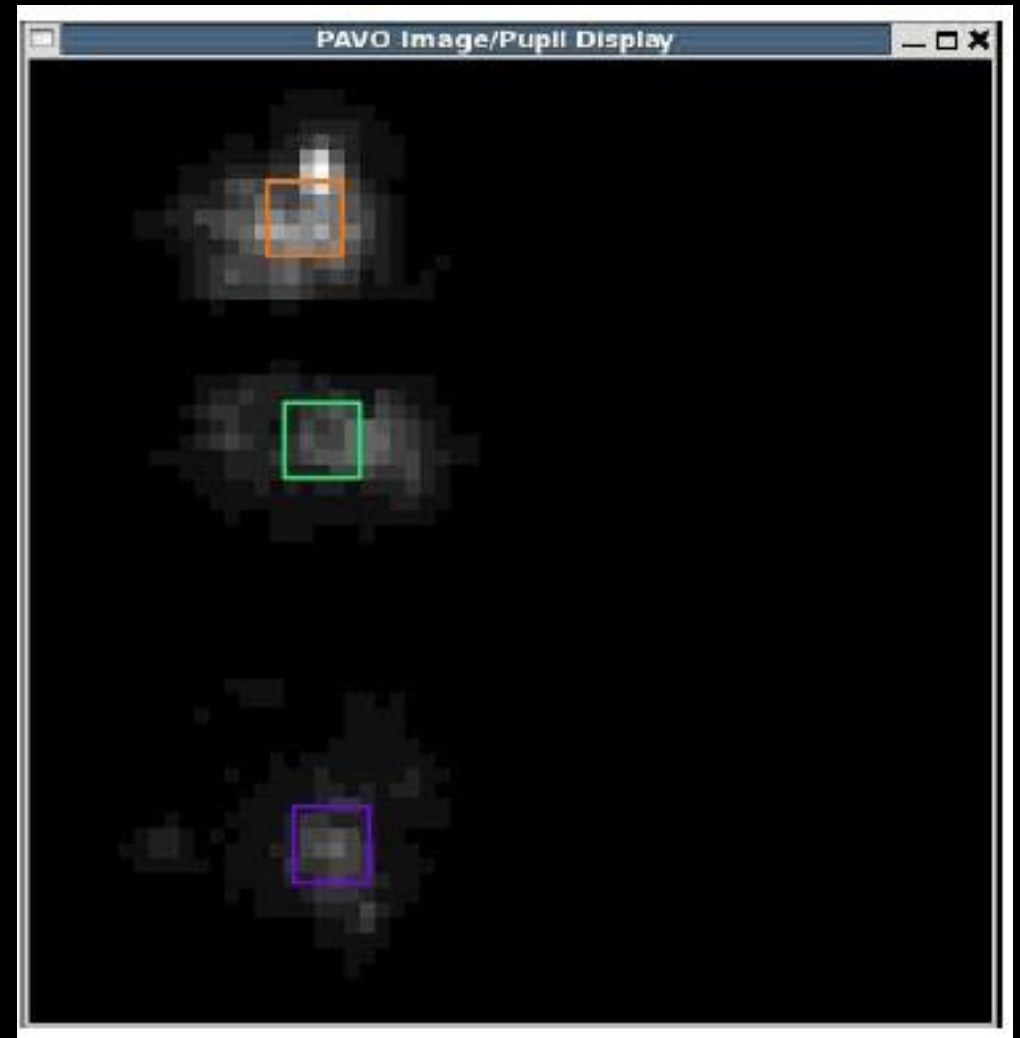


Observing with PAVO

The PAVO GUI



Toggles the Display Window



**Image View
Mask Out**

Observing with PAVO

The PAVO GUI



Toggles the Display Window

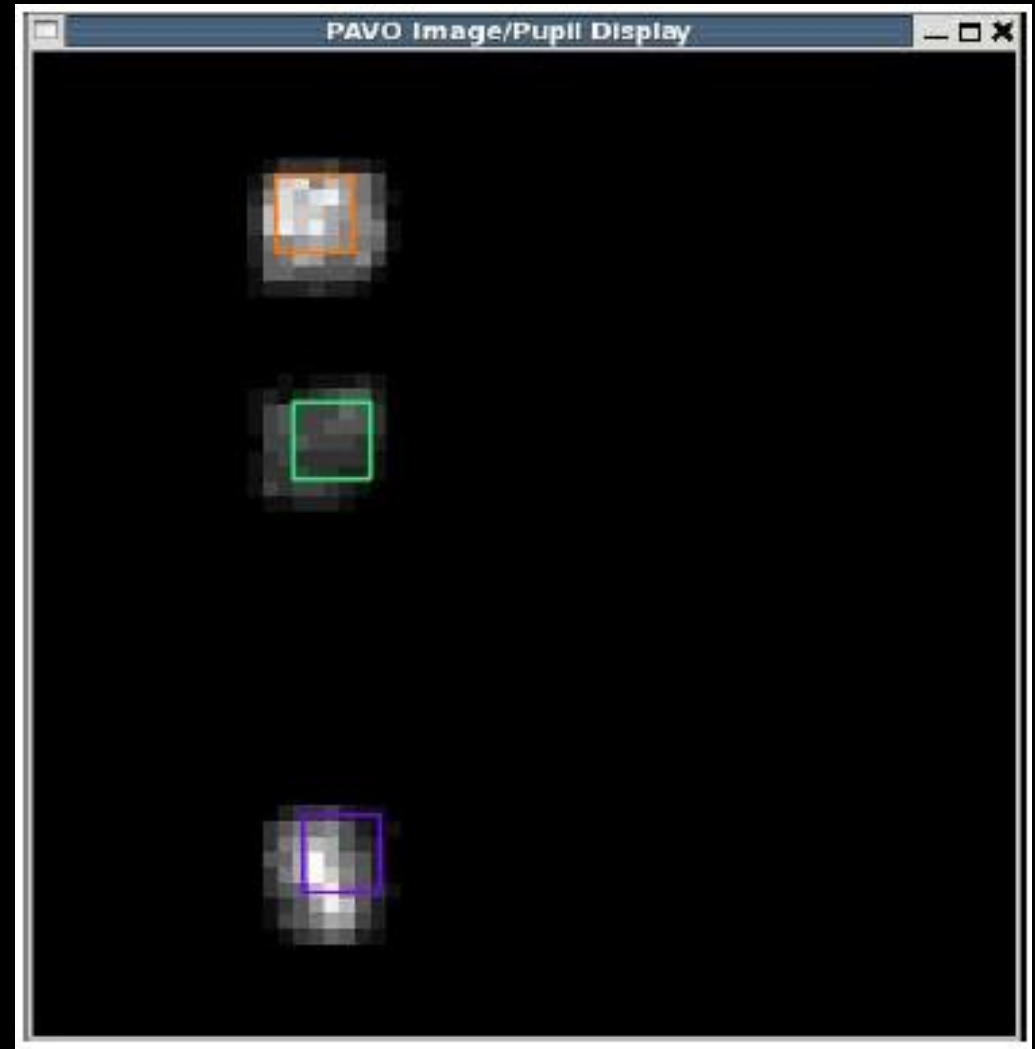
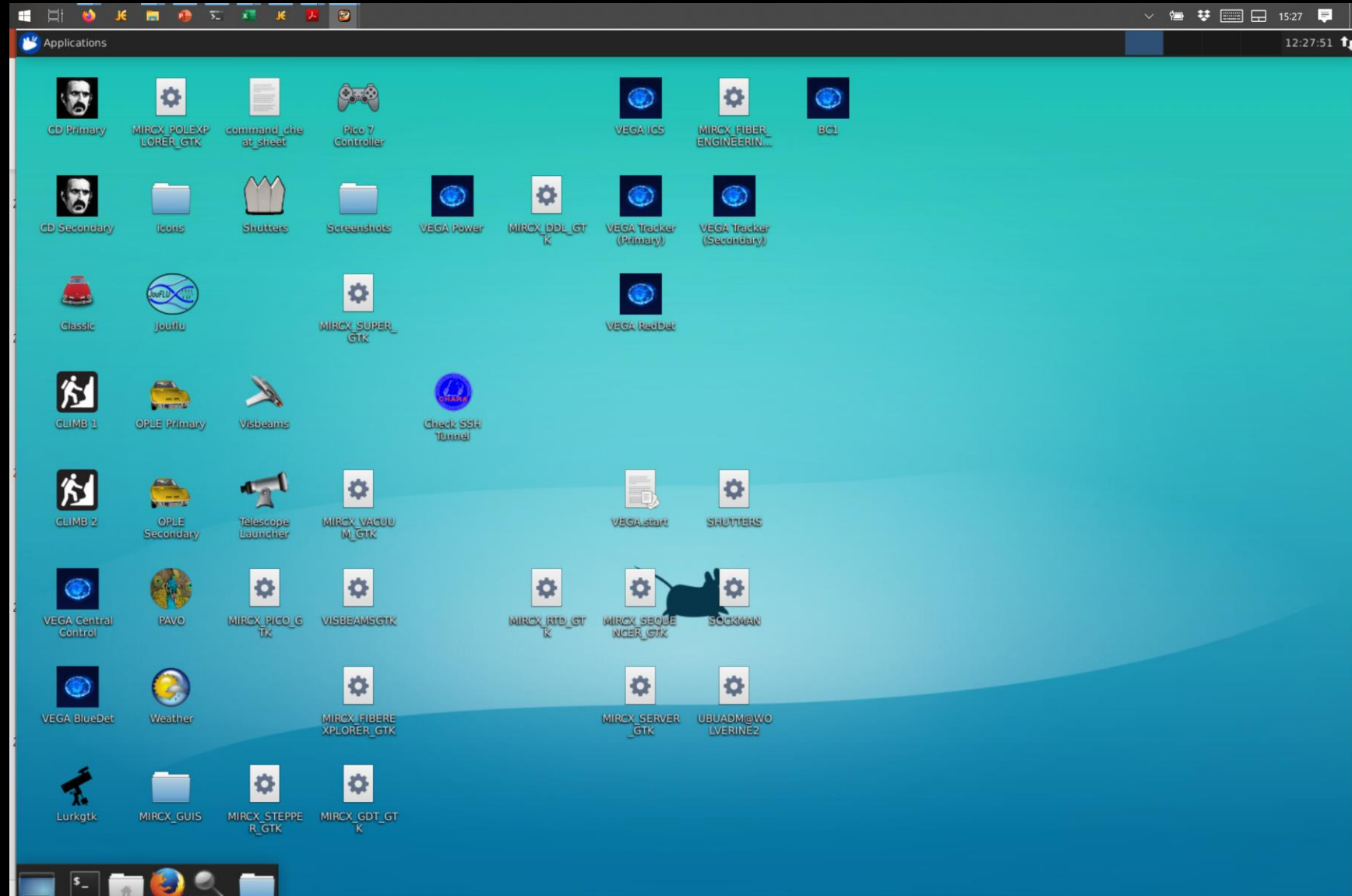


Image View
Mask In

Observing with PAVO

A Typical Night

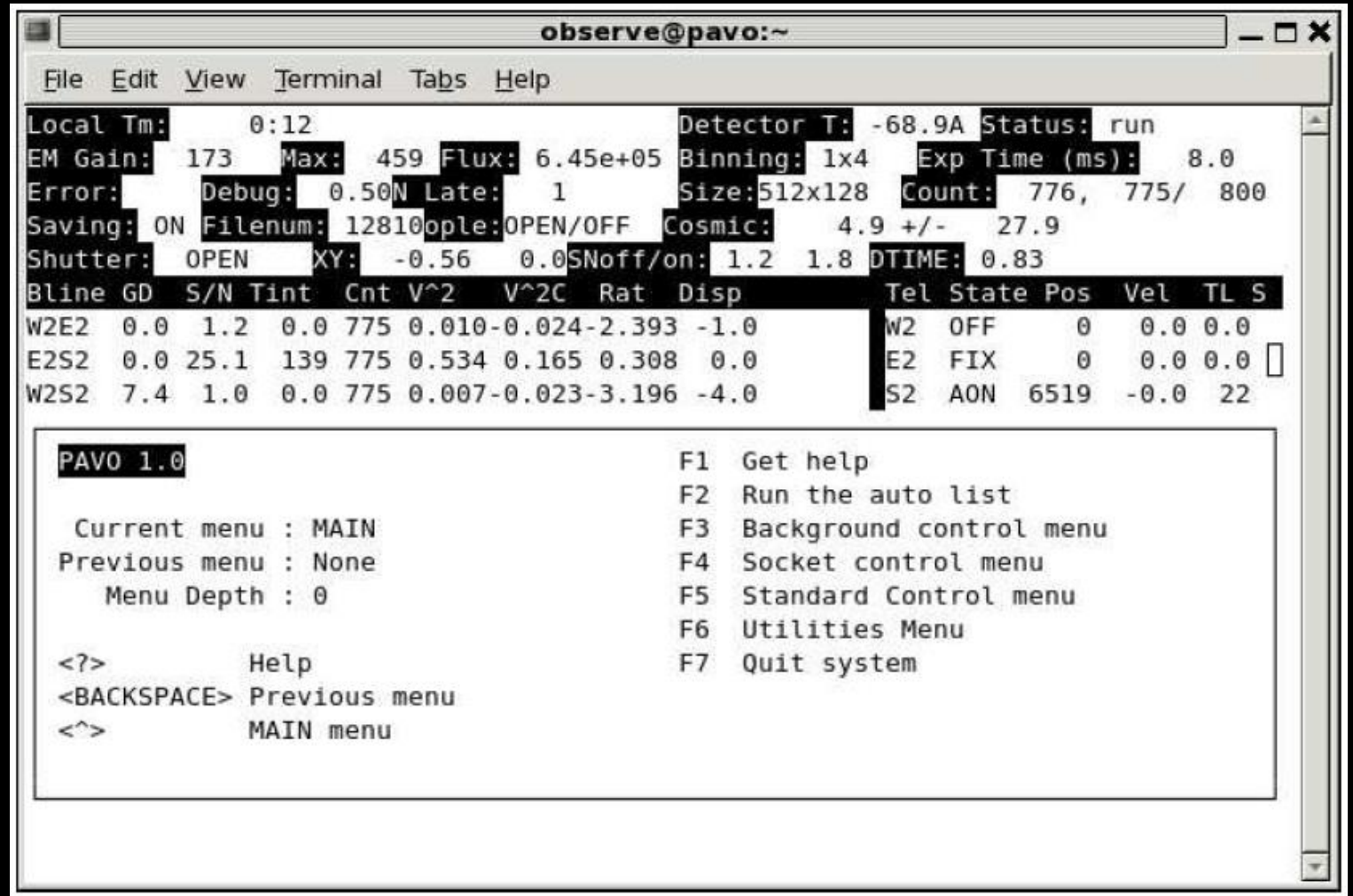
- Log onto Remote Machine



Observing with PAVO

A Typical Night

- Log onto Remote Machine
- Sign onto PAVO machine
- Run PAVO Server



```
observe@pavo:~
File Edit View Terminal Tabs Help
Local Tm: 0:12 Detector T: -68.9A Status: run
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800
Saving: ON Filenum: 12810 oplo: OPEN/OFF Cosmic: 4.9 +/- 27.9
Shutter: OPEN XY: -0.56 0.0 SNoff/on: 1.2 1.8 DTIME: 0.83
Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.393 -1.0 W2 OFF 0 0.0 0.0
E2S2 0.0 25.1 139 775 0.534 0.165 0.308 0.0 E2 FIX 0 0.0 0.0
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.196 -4.0 S2 AON 6519 -0.0 22

PAVO 1.0
Current menu : MAIN
Previous menu : None
Menu Depth : 0

<?> Help
<BACKSPACE> Previous menu
<^> MAIN menu

F1 Get help
F2 Run the auto list
F3 Background control menu
F4 Socket control menu
F5 Standard Control menu
F6 Utilities Menu
F7 Quit system
```

Observing with PAVO

A Typical Night

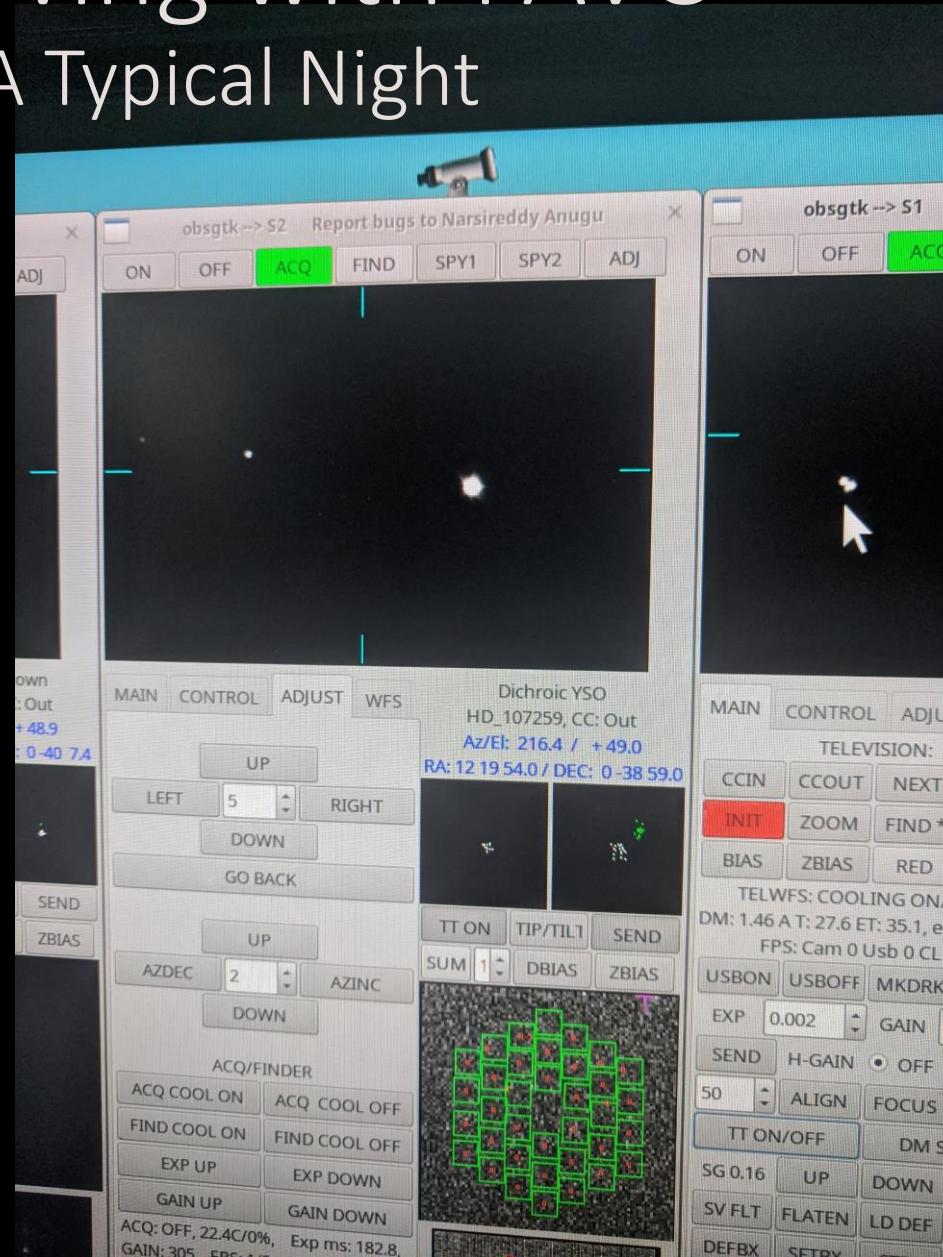
- Log onto Remote Machine
- Sign onto PAVO machine
- Run PAVO Server
- Run PAVO GUI



Observing with PAVO

A Typical Night

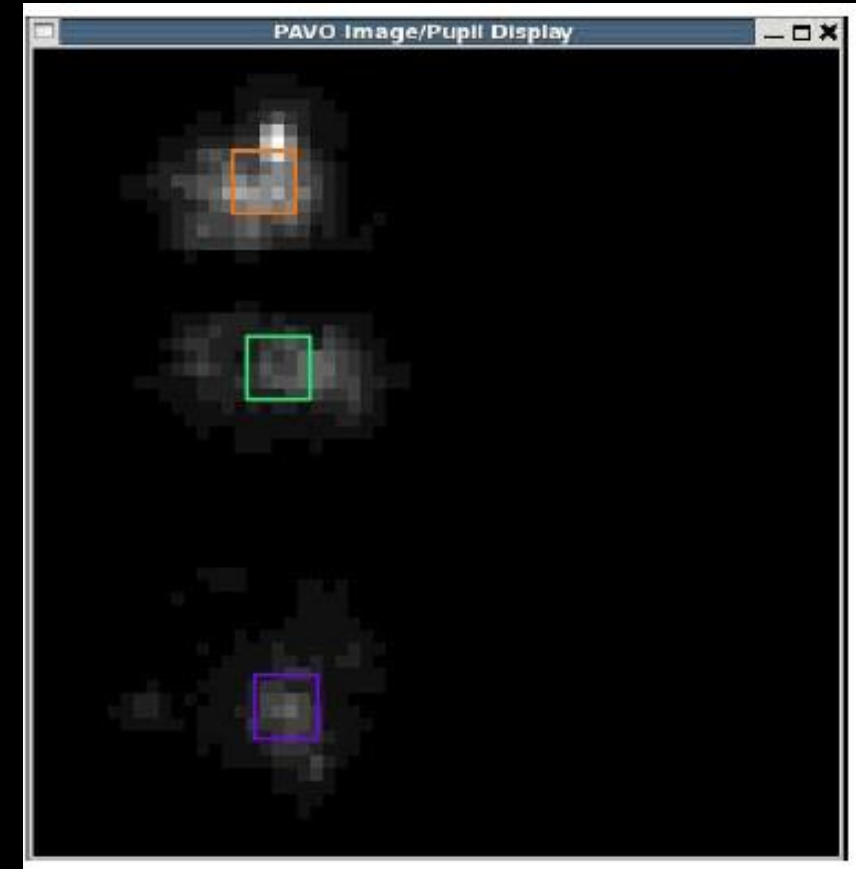
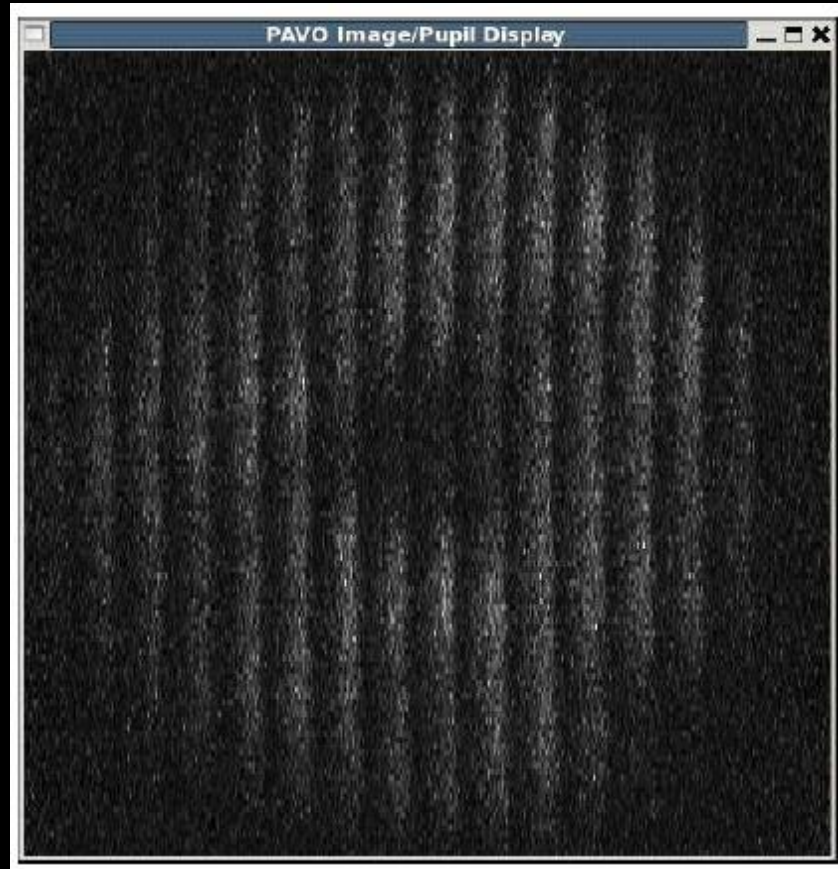
- Log onto Remote Machine
- Sign onto PAVO machine
- Run PAVO Server
- Run PAVO GUI
- Get On Sky!



Observing with PAVO

A Typical Night

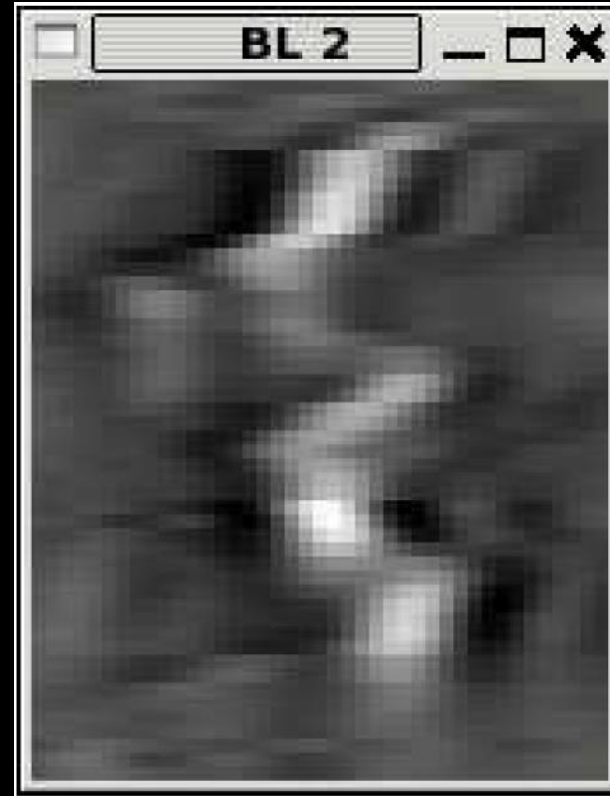
- Log onto Remote Machine
- Sign onto PAVO machine
- Run PAVO Server
- Run PAVO GUI
- Get On Sky!
- Do On Sky Alignments



Observing with PAVO

An Ideal Night

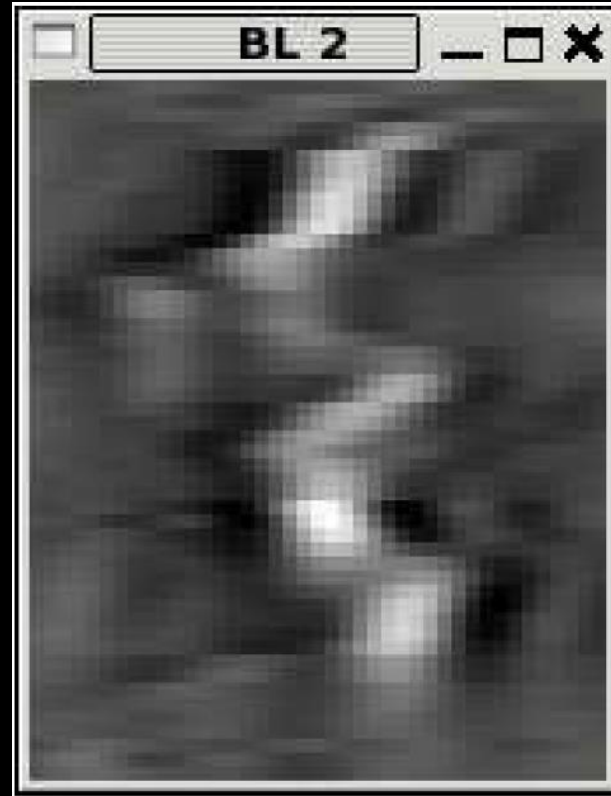
- Log onto Remote Machine
- Sign onto PAVO machine
- Run PAVO Server
- Run PAVO GUI
- Get On Sky!
- Do On Sky Alignments
- Find Fringes!



Observing with PAVO

An Ideal Night

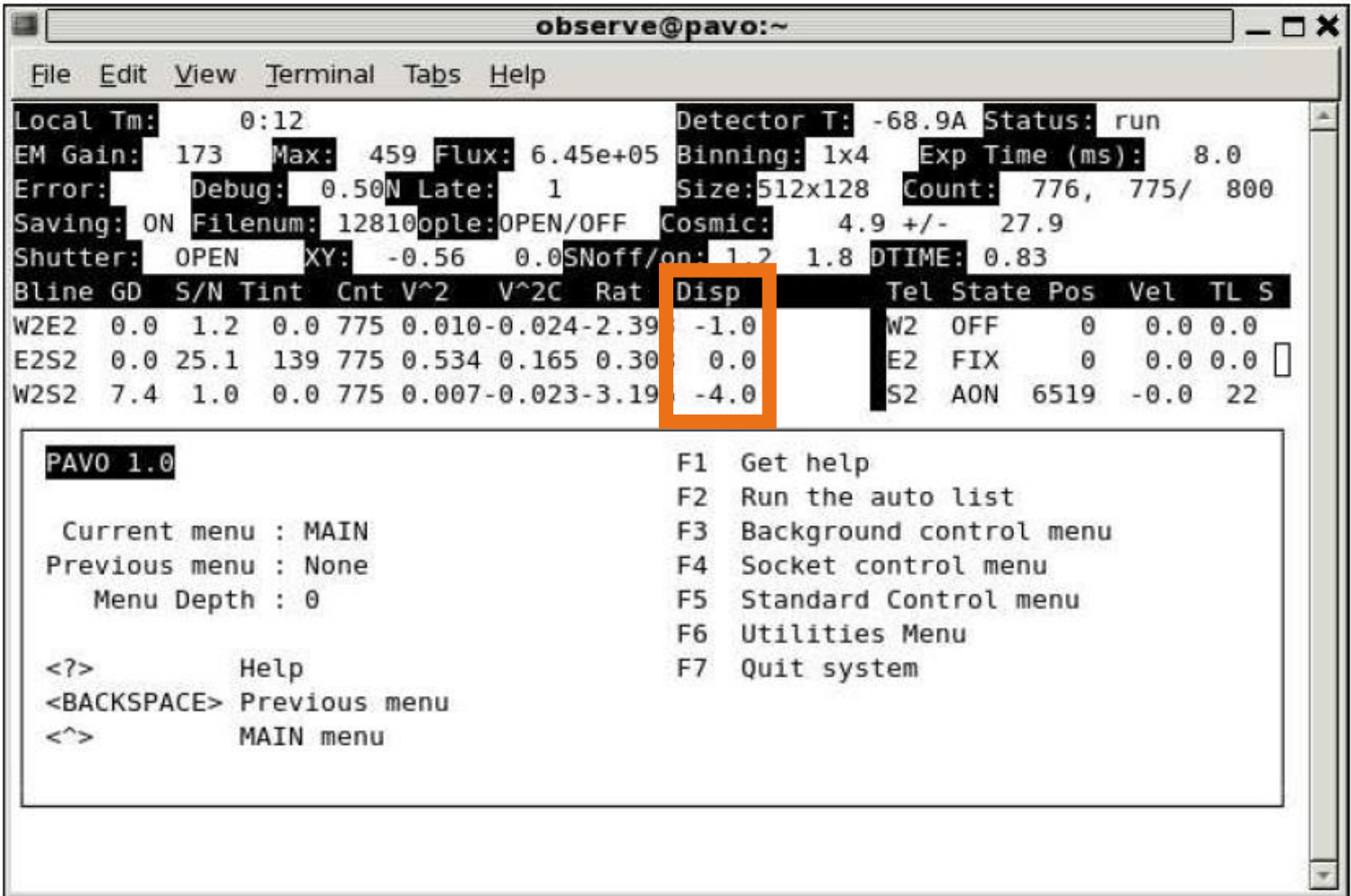
- Log onto Remote Machine
- Sign onto PAVO machine
- Run PAVO Server
- Run PAVO GUI
- Get On Sky!
- Do On Sky Alignments
- Find Fringes!
- Toggle LDCs
 - Fringes Disappear
 - Fringes Reappear!



Observing with PAVO

An Ideal Night

- Log onto Remote Machine
- Sign onto PAVO machine
- Run PAVO Server
- Run PAVO GUI
- Get On Sky!
- Do On Sky Alignments
- Find Fringes!
- Toggle LDCs
 - Fringes Disappear
 - Fringes Reappear!
- Check Dispersion
 - Good if 0-1



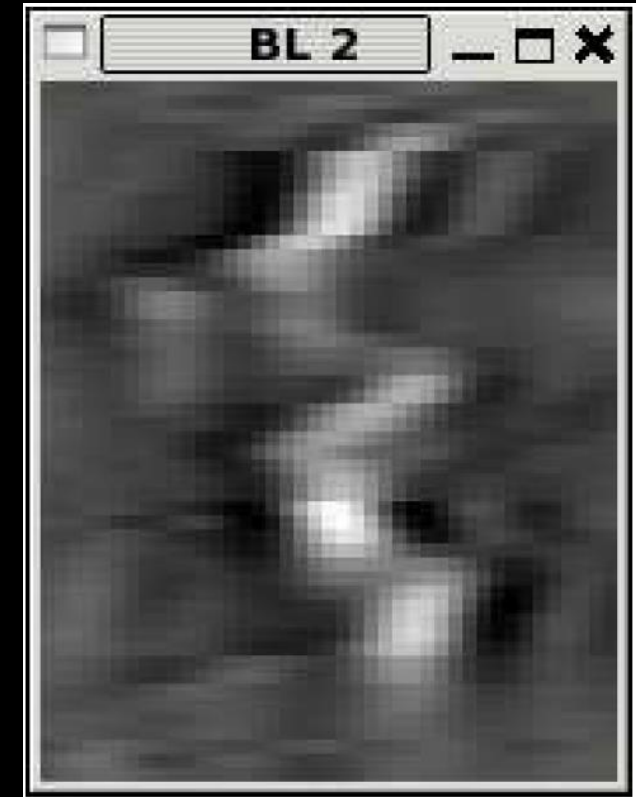
```
observe@pavo:~
File Edit View Terminal Tabs Help
Local Tm: 0:12 Detector T: -68.9A Status: run
EM Gain: 173 Max: 459 Flux: 6.45e+05 Binning: 1x4 Exp Time (ms): 8.0
Error: Debug: 0.50N Late: 1 Size: 512x128 Count: 776, 775/ 800
Saving: ON Filenum: 12810 oplo: OPEN/OFF Cosmic: 4.9 +/- 27.9
Shutter: OPEN XY: -0.56 0.0 SNoff/on: 1.2 1.8 DTIME: 0.83
Bline GD S/N Tint Cnt V^2 V^2C Rat Disp Tel State Pos Vel TL S
W2E2 0.0 1.2 0.0 775 0.010-0.024-2.39 -1.0 W2 OFF 0 0.0 0.0
E2S2 0.0 25.1 139 775 0.534 0.165 0.30 0.0 E2 FIX 0 0.0 0.0
W2S2 7.4 1.0 0.0 775 0.007-0.023-3.19 -4.0 S2 AON 6519 -0.0 22

PAVO 1.0
Current menu : MAIN
Previous menu : None
Menu Depth : 0
<?> Help
<BACKSPACE> Previous menu
<^> MAIN menu
F1 Get help
F2 Run the auto list
F3 Background control menu
F4 Socket control menu
F5 Standard Control menu
F6 Utilities Menu
F7 Quit system
```


Observing with PAVO

An Ideal Night

- Log onto Remote Machine
- Sign onto PAVO machine
- Run PAVO Server
- Run PAVO GUI
- Get On Sky!
- Do On Sky Alignments
- Find Fringes!
- Toggle LDCs
 - Fringes Disappear
 - Fringes Reappear!
- Check Dispersion
 - Good if 0-1
- Save Data!



Reducing PAVO Data

Find Your Data

```
File Edit View Terminal Tabs Help
jones@Chara-Reduction:~$ find_pavo_target HD_154494
HD_154494 found in:
    /dbstorage/PAVO/2011/110530/headstrip.txt
    /dbstorage/PAVO/2018/180226/headstrip.txt
    /dbstorage/PAVO/2018/180411/headstrip.txt
jones@Chara-Reduction:~$
```

Reducing PAVO Data

The headstrip file

- UT – UT time of the first file
- FNUM – Starting file number
- HD – HD number of the target
- SHT – Shutter status of 3 beams
 - B1, B2, and B3
 - 0 – open
 - 1 – closed
- GN – Gain setting of the detector
- EXPTM – Exposure time of the detector
- CX – Offset of OPLE cart X
 - Carts are moved during shutter sequence
 - Expect to see a difference then
- BX – Identifies the telescope on each beam

headstrip.txt (/dbstorage/PAVO/2018/180226/)

1	UT	FNUM	HD	SHT	L	M	GN	EXPTM	AX1	C1	C2	C3	B1	B2	B3
2	03:10	00000	HD_27309	000	1	3	170	8.0	128	0	0	6414	W2	S2	E2
3	03:14	00596	HD_27309	011	1	3	170	8.0	128	-1500	0	9450	W2	S2	E2
4	03:15	00623	HD_27309	101	1	3	170	8.0	128	-1500	0	9450	W2	S2	E2
5	03:15	00650	HD_27309	110	1	3	170	8.0	128	-1500	0	9450	W2	S2	E2
6	03:15	00677	HD_27309	111	1	3	170	8.0	128	-1500	0	9450	W2	S2	E2
7	03:45	00836	HD_27459	000	1	3	170	8.0	128	0	0	6641	W2	S2	E2
8	03:50	01510	HD_27459	011	1	3	170	8.0	128	-1500	0	9701	W2	S2	E2
9	03:50	01537	HD_27459	101	1	3	170	8.0	128	-1500	0	9701	W2	S2	E2
10	03:50	01564	HD_27459	110	1	3	170	8.0	128	-1500	0	9701	W2	S2	E2
11	03:50	01590	HD_27459	111	1	3	170	8.0	128	-1500	0	9701	W2	S2	E2
12	03:51	01650	HD_27778	111	1	3	170	8.0	128	-1500	0	9701	W2	S2	E2
13	03:58	01752	HD_27778	000	1	3	170	8.0	128	0	0	6406	W2	S2	E2
14	04:04	02547	HD_27778	011	1	3	170	8.0	128	-1500	0	9435	W2	S2	E2
15	04:04	02573	HD_27778	101	1	3	170	8.0	128	-1500	0	9435	W2	S2	E2
16	04:04	02600	HD_27778	110	1	3	170	8.0	128	-1500	0	9435	W2	S2	E2
17	04:04	02627	HD_27778	111	1	3	170	8.0	128	-1500	0	9435	W2	S2	E2
18	04:05	02696	HD_27459	111	1	3	170	8.0	128	-1500	0	9435	W2	S2	E2
19	04:07	02787	HD_27459	000	1	3	170	8.0	128	0	0	6438	W2	S2	E2
20	04:12	03450	HD_27459	011	1	3	170	8.0	128	-1500	0	9716	W2	S2	E2
21	04:12	03476	HD_27459	101	1	3	170	8.0	128	-1500	0	9716	W2	S2	E2
22	04:12	03503	HD_27459	110	1	3	170	8.0	128	-1500	0	9716	W2	S2	E2
23	04:12	03530	HD_27459	111	1	3	170	8.0	128	-1500	0	9716	W2	S2	E2
24	04:13	03559	HD_27778	111	1	3	170	8.0	128	-1500	0	9716	W2	S2	E2
25	04:14	03689	HD_27778	000	1	3	170	8.0	128	-1500	0	9716	W2	S2	E2
26	04:21	04442	HD_27778	011	1	3	170	8.0	128	-1500	0	9443	W2	S2	E2
27	04:21	04469	HD_27778	101	1	3	170	8.0	128	-1500	0	9443	W2	S2	E2
28	04:22	04495	HD_27778	110	1	3	170	8.0	128	-1500	0	9443	W2	S2	E2
29	04:22	04522	HD_27778	111	1	3	170	8.0	128	-1500	0	9443	W2	S2	E2
30	04:22	04609	HD_27309	111	1	3	170	8.0	128	-1500	0	9443	W2	S2	E2

Reducing PAVO Data

Start IDL

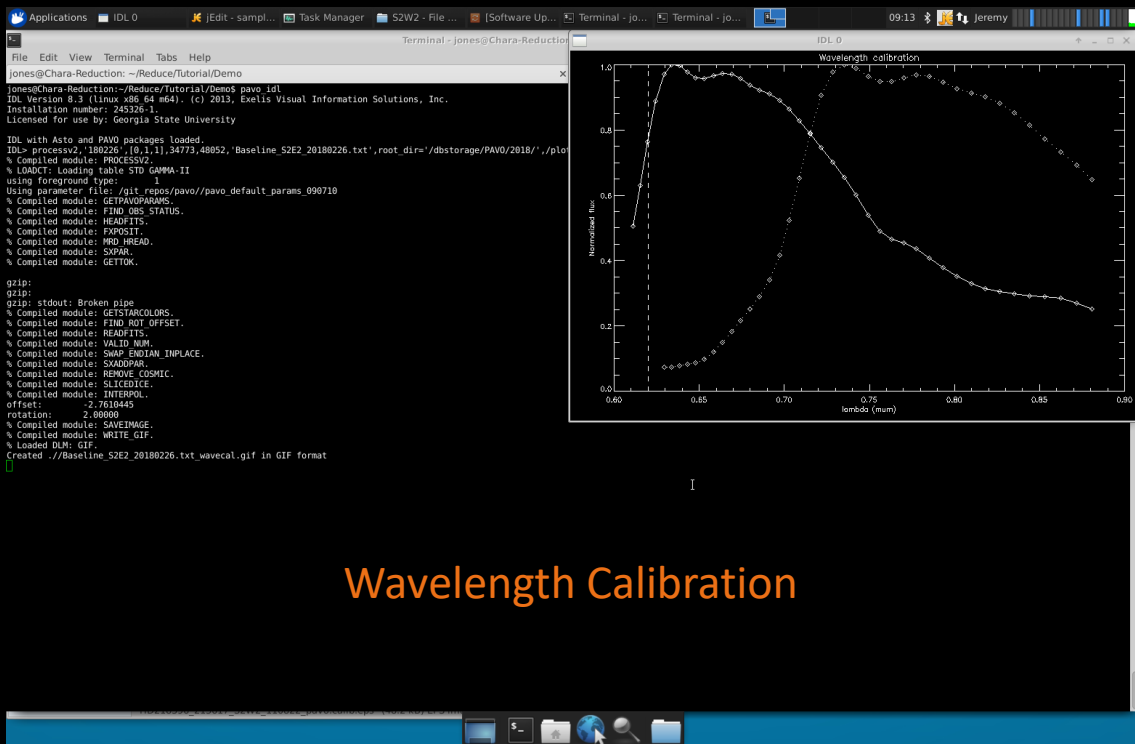
```
File Edit View Terminal Tabs Help
jones@Chara_Reduction:~$ pavo_idl
IDL Version 8.3 (linux x86_64 m64). (c) 2013, Exelis Visual Information Solutions, Inc.
Installation number: 245326-1.
Licensed for use by: Georgia State University
IDL with Asto and PAVO packages loaded.
IDL>
```

Reducing PAVO Data

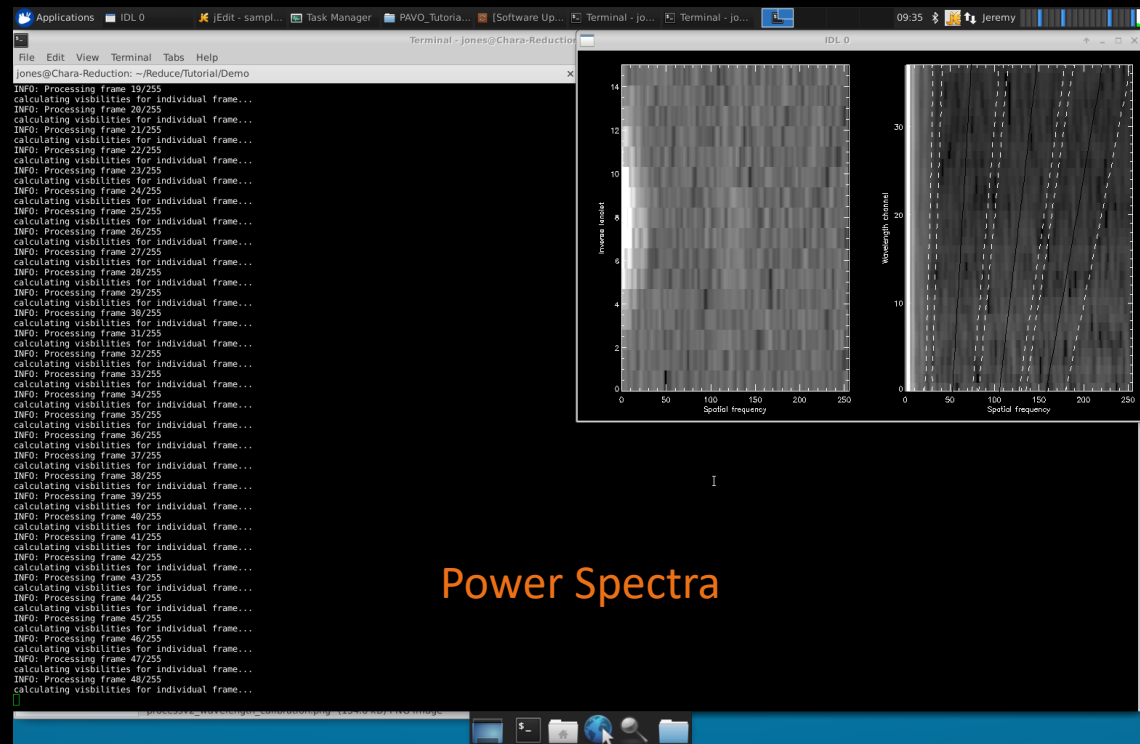
Run processv2

Obs Date Beams File Range Output Filename Data Directory Options

`processv2, '180226', [0,1,1], 34773,48052, 'Baseline_S2E2_20180226.txt', root_dir='/dbstorage/PAVO/2018/', /plot, /individual`



Wavelength Calibration



Power Spectra

Note: processv2 cannot process multiple baselines at once

Reducing PAVO Data

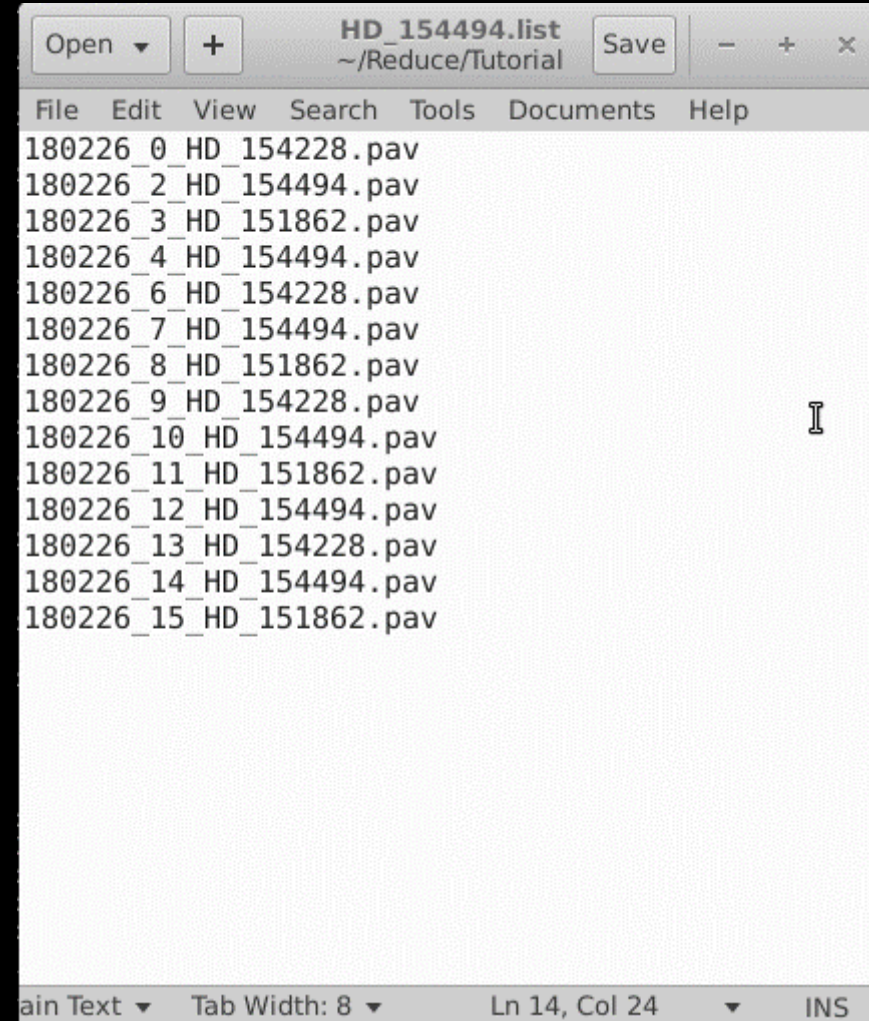
I0_I1_gui.pro – Preparation

- Level 0 Data – Raw Visibilities
Output from processv2
- Level 1 Data – Reduced Visibilities
Uncalibrated
- Level 2 Data – Reduced Visibilities
Calibrated

Reducing PAVO Data

I0_I1_gui.pro – Preparation

- Level 0 Data – Raw Visibilities
Output from processv2
- Level 1 Data – Reduced Visibilities
Uncalibrated
- Level 2 Data – Reduced Visibilities
Calibrated



The screenshot shows a text editor window titled "HD_154494.list" with the path "~/Reduce/Tutorial". The window contains a list of 16 files, each with a unique identifier and a filename. The status bar at the bottom indicates "Ln 14, Col 24".

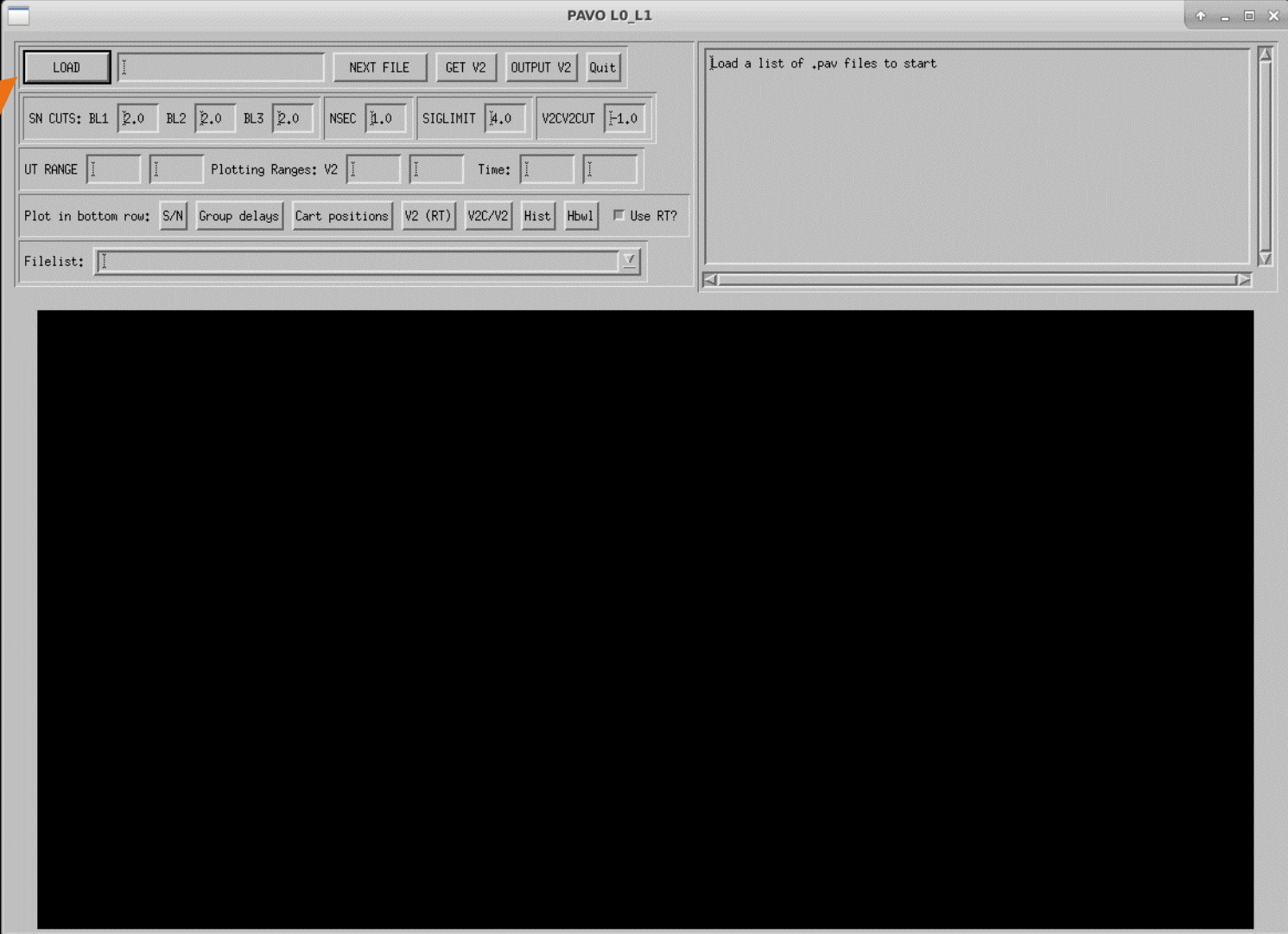
```
Open + HD_154494.list ~/Reduce/Tutorial Save - + x
File Edit View Search Tools Documents Help
180226_0_HD_154228.pav
180226_2_HD_154494.pav
180226_3_HD_151862.pav
180226_4_HD_154494.pav
180226_6_HD_154228.pav
180226_7_HD_154494.pav
180226_8_HD_151862.pav
180226_9_HD_154228.pav
180226_10_HD_154494.pav
180226_11_HD_151862.pav
180226_12_HD_154494.pav
180226_13_HD_154228.pav
180226_14_HD_154494.pav
180226_15_HD_151862.pav
ain Text Tab Width: 8 Ln 14, Col 24 INS
```

Reducing PAVO Data

10_11_gui.pro – Startup

Call With: 10_11_gui

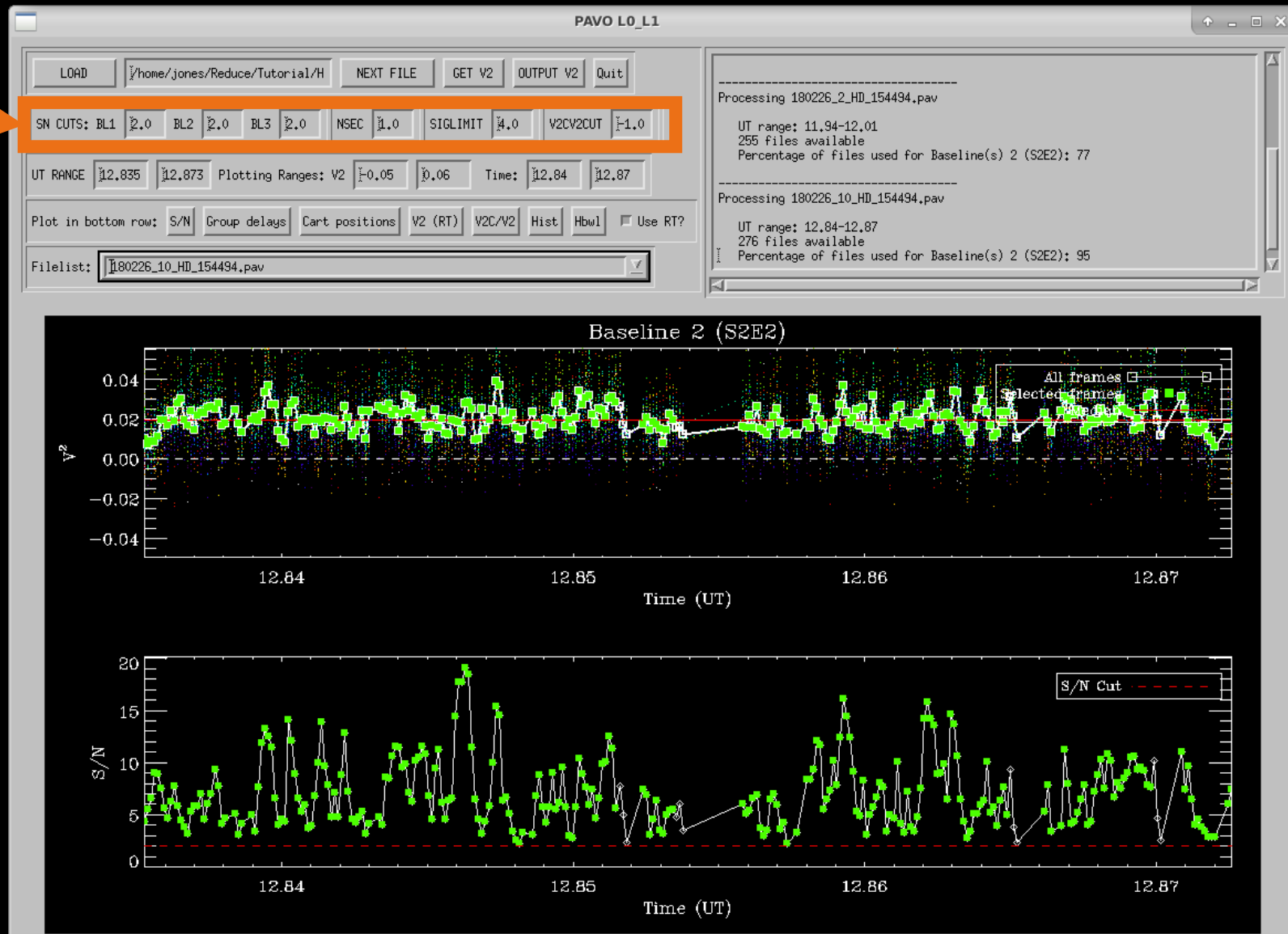
Load the List File



Reducing PAVO Data l0_l1_gui.pro

Outlier Rejection:

- Signal-to-Noise Ratio (SN)
- Seconds after lost fringe lock (NSEC)
- Deviation from the mean in sigma (SIGLIMIT)



Reducing PAVO Data

l0_l1_gui.pro

Outlier Rejection:

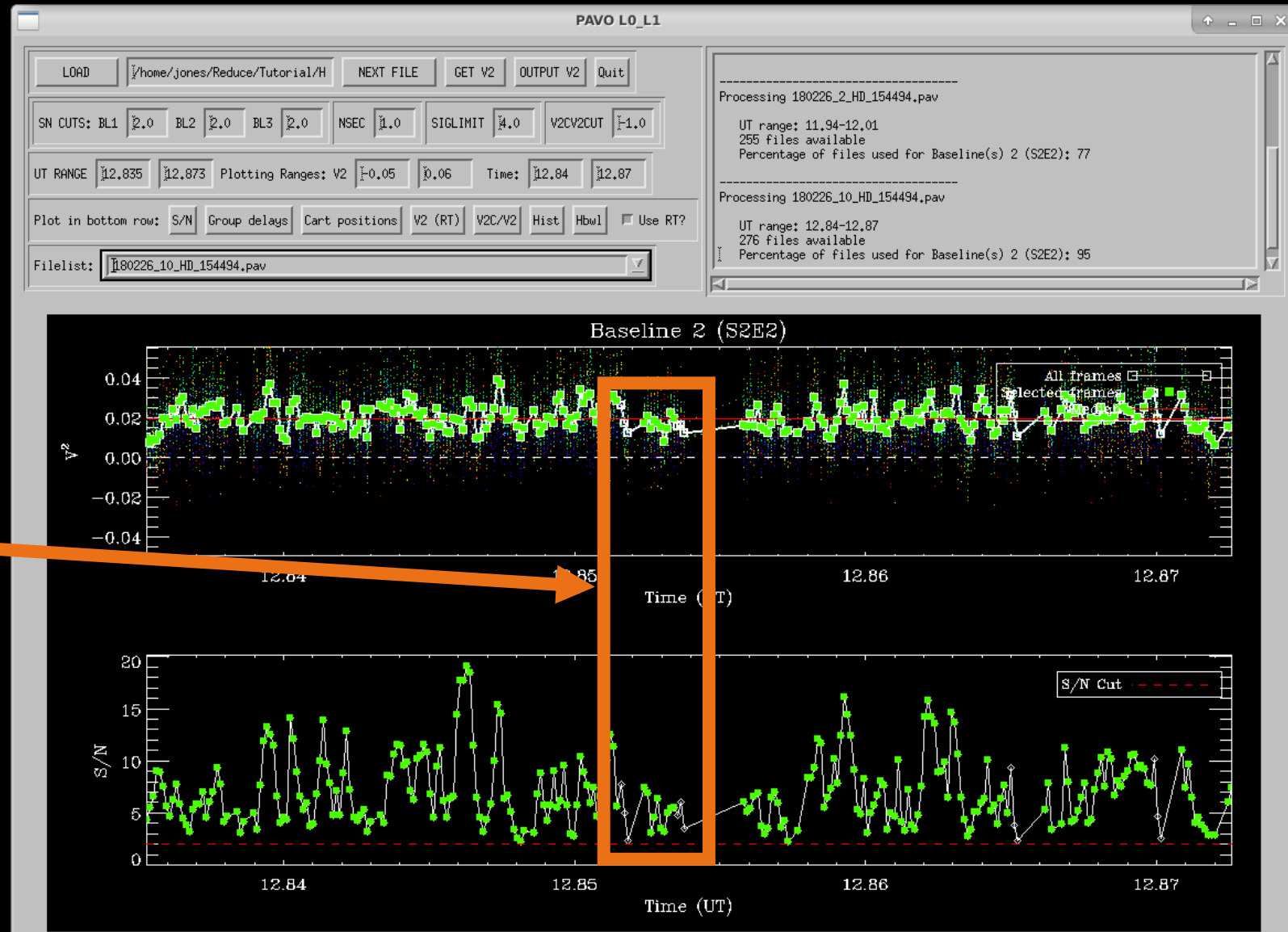
- Signal-to-Noise Ratio (SN)
- Seconds after lost fringe lock (NSEC)
- Deviation from the mean in sigma (SIGLIMIT)

Open White Squares:

Rejected (by NSEC in this case)

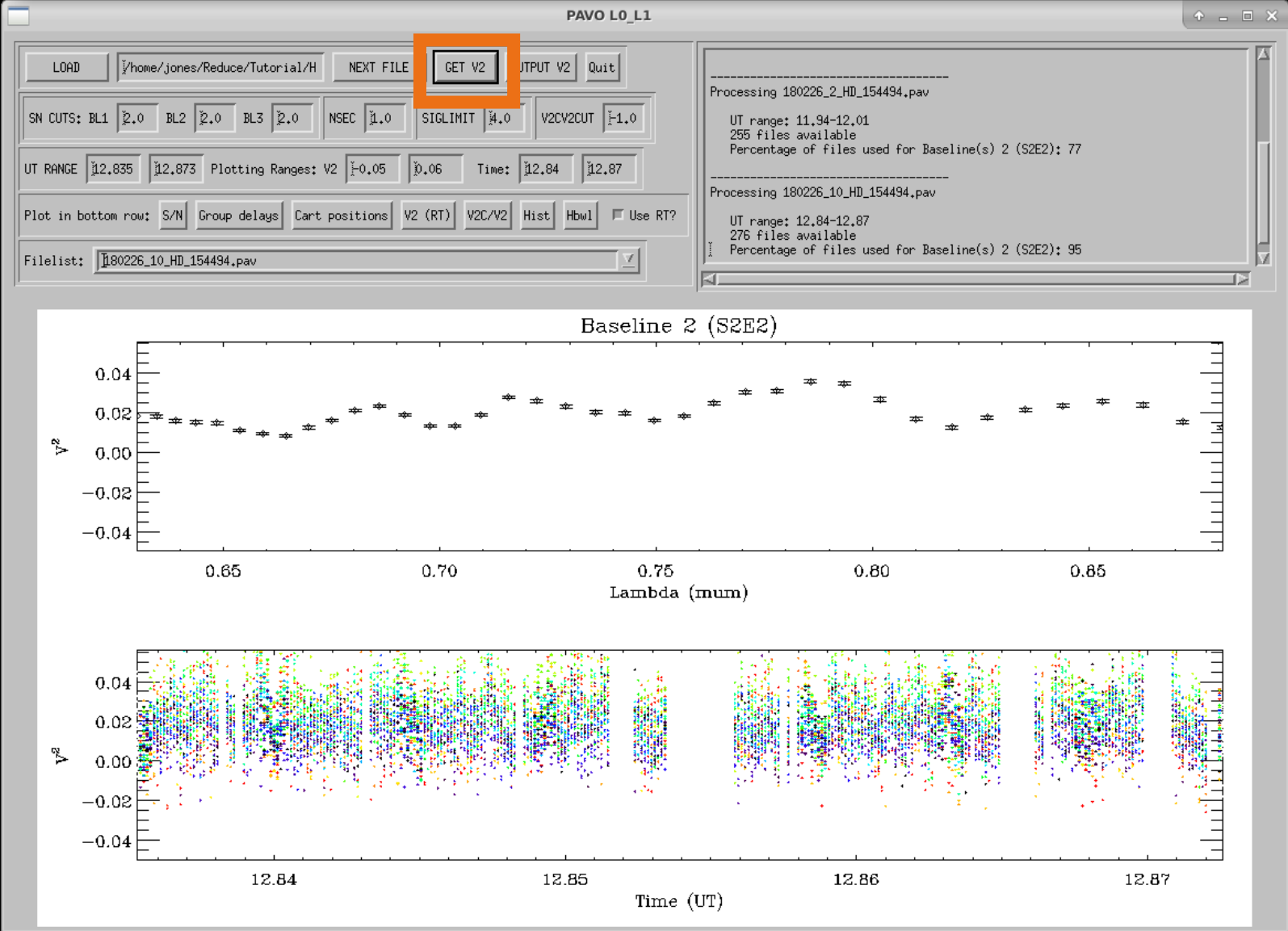
Filled Green Squares:

Accepted



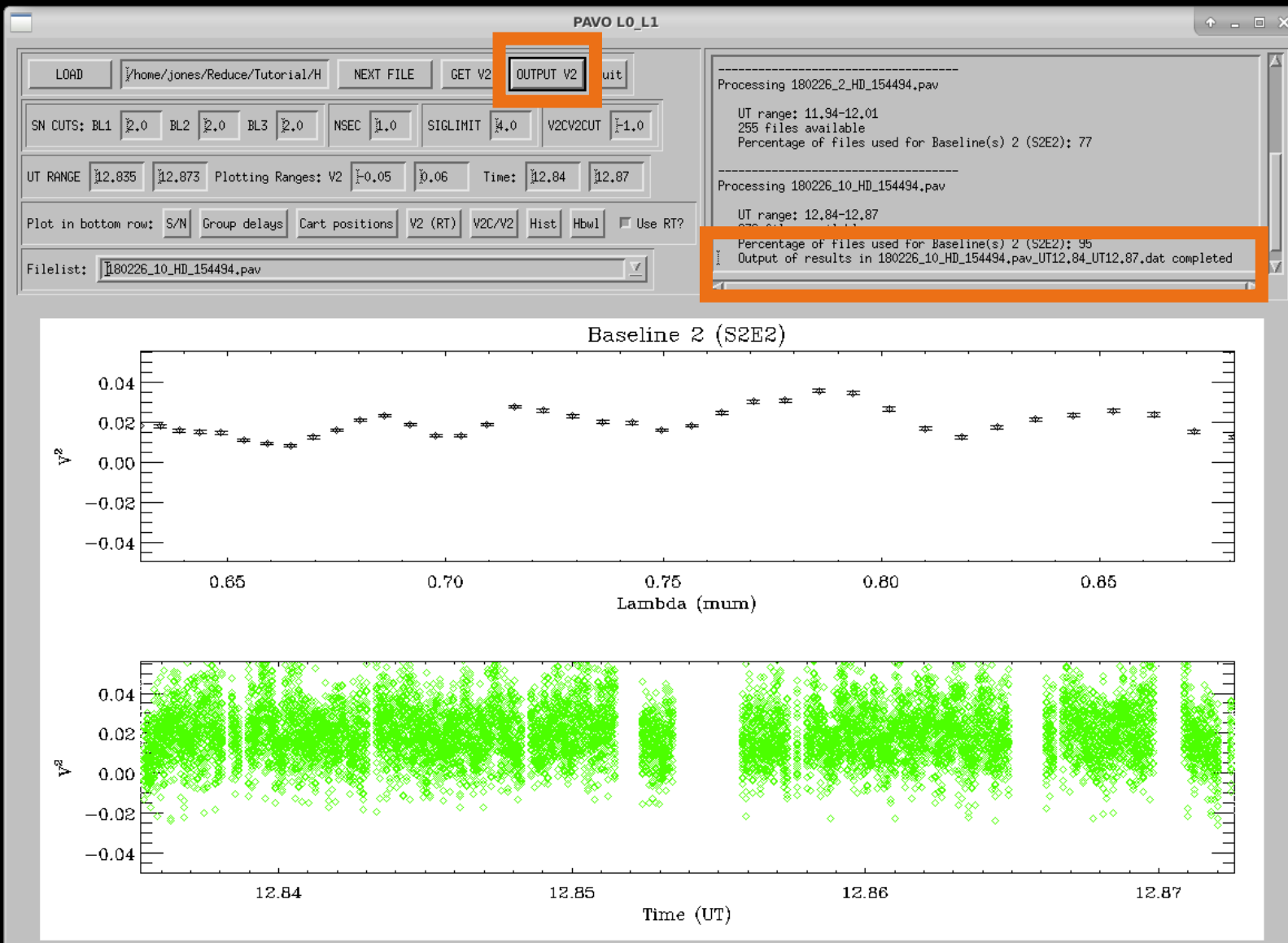
Reducing PAVO Data

l0_l1_gui.pro



Reducing PAVO Data

l0_l1_gui.pro



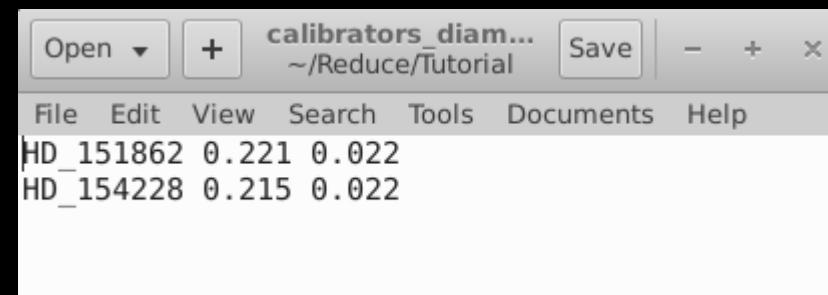
Calibrating PAVO Data

l1_l2_gui.pro – Preparation

Level 0 Data – Raw Visibilities
Output from processv2

Level 1 Data – Reduced Visibilities
Uncalibrated

Level 2 Data – Reduced Visibilities
Calibrated



```
; configuration file for multi-bracket diameter fitting using Monte-Carlo simulations
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
5041.      ; number of MC iterations
1.         ; lambda_smooth value used
0.4        ; initial guess for target diameter
0.628      ; linear limb darkening coefficient
0.02       ; absolute uncertainty on linear limb darkening coefficient
5.         ; absolute uncertainty on wavelength scale (nm)
5.         ; relative uncertainty on calibrator diameters (%)
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;bracket 1 (first line: Target scans; second line: Calibrator Scans)
180226_2_HD_154494.pav
180226_0_HD_154228.pav,180226_3_HD_151862.pav
;bracket 2
180226_4_HD_154494.pav
180226_3_HD_151862.pav,180226_6_HD_154228.pav
;bracket 3
180226_7_HD_154494.pav
180226_6_HD_154228.pav,180226_8_HD_151862.pav
;bracket 4
180226_10_HD_154494.pav
180226_9_HD_154228.pav,180226_11_HD_151862.pav
;bracket 5
180226_12_HD_154494.pav
180226_11_HD_151862.pav,180226_13_HD_154228.pav
;bracket 6
180226_14_HD_154494.pav
180226_13_HD_154228.pav,180226_15_HD_151862.pav
```

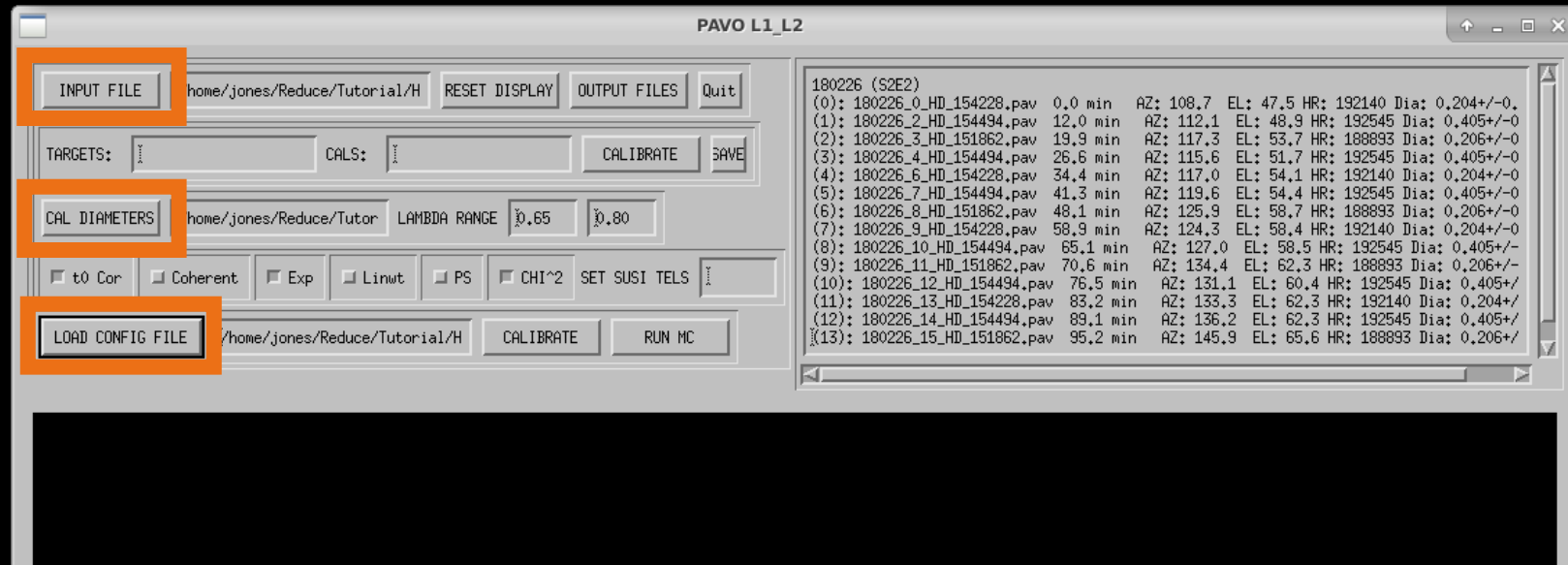
Calibrating PAVO Data

l1_l2_gui.pro – Startup

l0_l1_gui results file: blah_l0l1.res →

Calibrator diameters file →

Configuration file →



Calibrating PAVO Data

l1_l2_gui.pro

PAVO L1_L2

INPUT FILE: /home/jones/Reduce/Tutorial/H RESET DISPLAY OUTPUT FILES Quit

TARGETS: CALS: CALIBRATE SAVE

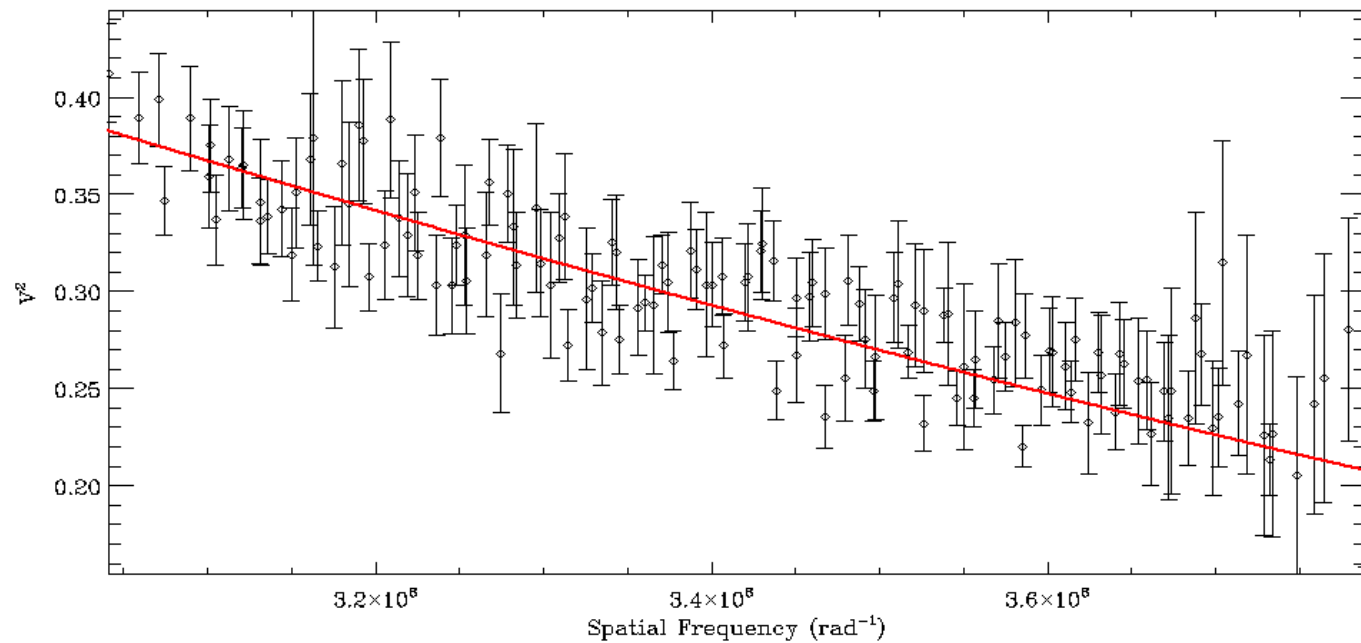
CAL DIAMETERS: /home/jones/Reduce/Tutor LAMBDA RANGE: 0.65 0.80

t0 Cor Coherent Exp Linut PS CHI^2 SET SUSI TELS

LOAD CONFIG FILE: /home/jones/Reduce/Tutorial/H CALIBRATE RUN MC

```
(2): 180226_3_HD_151862.pav 19,9 min  AZ: 117,3  EL: 53,7 HR: 188893 Dia: 0.221+/-0
(3): 180226_4_HD_154494.pav 26,6 min  AZ: 115,6  EL: 51,7 HR: 192545 Dia: 0.405+/-0
(4): 180226_6_HD_154228.pav 34,4 min  AZ: 117,0  EL: 54,1 HR: 192140 Dia: 0.215+/-0
(5): 180226_7_HD_154494.pav 41,3 min  AZ: 119,6  EL: 54,4 HR: 192545 Dia: 0.405+/-0
(6): 180226_8_HD_151862.pav 48,1 min  AZ: 125,9  EL: 58,7 HR: 188893 Dia: 0.221+/-0
(7): 180226_9_HD_154228.pav 58,9 min  AZ: 124,3  EL: 58,4 HR: 192140 Dia: 0.215+/-0
(8): 180226_10_HD_154494.pav 65,1 min  AZ: 127,0  EL: 58,5 HR: 192545 Dia: 0.405+/-0
(9): 180226_11_HD_151862.pav 70,6 min  AZ: 134,4  EL: 62,3 HR: 188893 Dia: 0.221+/-0
(10): 180226_12_HD_154494.pav 76,5 min  AZ: 131,1  EL: 60,4 HR: 192545 Dia: 0.405+/-0
(11): 180226_13_HD_154228.pav 83,2 min  AZ: 133,3  EL: 62,3 HR: 192140 Dia: 0.215+/-0
(12): 180226_14_HD_154494.pav 89,1 min  AZ: 136,2  EL: 62,3 HR: 192545 Dia: 0.405+/-0
(13): 180226_15_HD_151862.pav 95,2 min  AZ: 145,9  EL: 65,6 HR: 188893 Dia: 0.221+/-0
```

Calibrating multiple brackets according to config file
diameter: 0.43094764+/-0.0010757730



Calibrating PAVO Data

l1_l2_gui.pro

PAVO L1_L2

INPUT FILE: RESET DISPLAY OUTPUT FILES Quit

TARGETS: CALS: CALIBRATE SAVE

CAL DIAMETERS: LAMBDA RANGE:

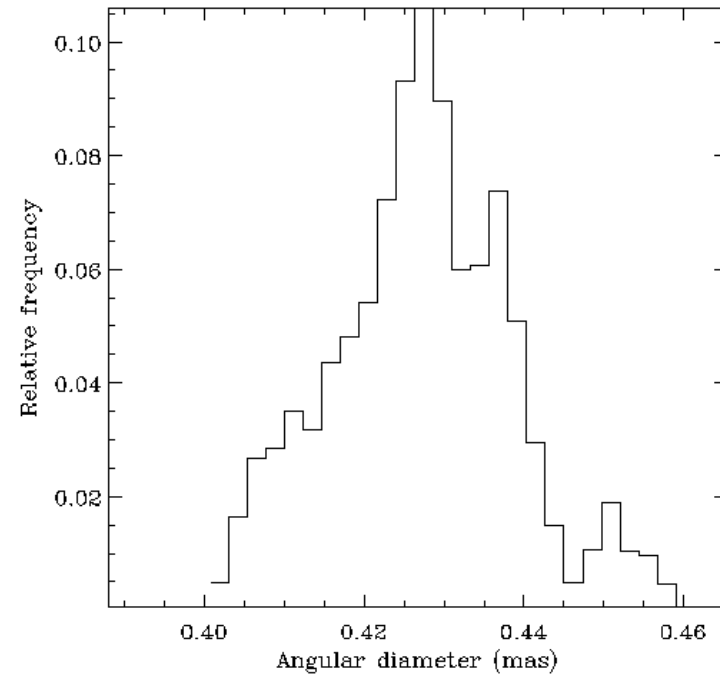
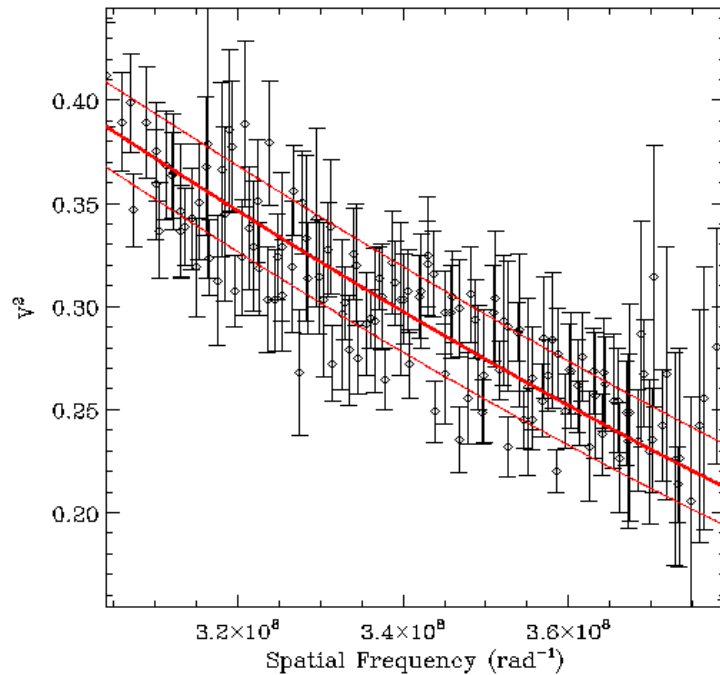
t0 Cor Coherent Exp Linut PS CHI^2 SET SUSI TELS:

LOAD CONFIG FILE: CALIBRATE **RUN MC**

```
(7): 180226_9_HD_154228.pav 58.9 min AZ: 124.3 EL: 58.4 HR: 192140 Dia: 0.215+/-0
(8): 180226_10_HD_154494.pav 65.1 min AZ: 127.0 EL: 58.5 HR: 192545 Dia: 0.405+/-
(9): 180226_11_HD_151862.pav 70.6 min AZ: 134.4 EL: 62.3 HR: 188893 Dia: 0.221+/-
(10): 180226_12_HD_154494.pav 76.5 min AZ: 131.1 EL: 60.4 HR: 192545 Dia: 0.405+/-
(11): 180226_13_HD_154228.pav 83.2 min AZ: 133.3 EL: 62.3 HR: 192140 Dia: 0.215+/-
(12): 180226_14_HD_154494.pav 89.1 min AZ: 136.2 EL: 62.3 HR: 192545 Dia: 0.405+/-
(13): 180226_15_HD_151862.pav 95.2 min AZ: 145.9 EL: 65.6 HR: 188893 Dia: 0.221+/-

Calibrating multiple brackets according to config file
diameter: 0.43094764+/-0.0010757730

fitted diameter: 0.43094764
Running MC simulation with 5041 iterations
mean & standard deviation: 0.42845301 +/- 0.011441837
median & credible ( 68.0%) regions: 0.42836435 + 0.010617739 - 0.011532481
```



Calibrating PAVO Data

l1_l2_gui.pro – Results

PAVO L1_L2

INPUT FILE: /home/jones/Reduce/Tutorial/H RESET DISPLAY **OUTPUT FILES** quit

TARGETS: CALS: CALIBRATE SAVE

CAL DIAMETERS: /home/jones/Reduce/Tutor LAMBDA RANGE: 0.65 0.80

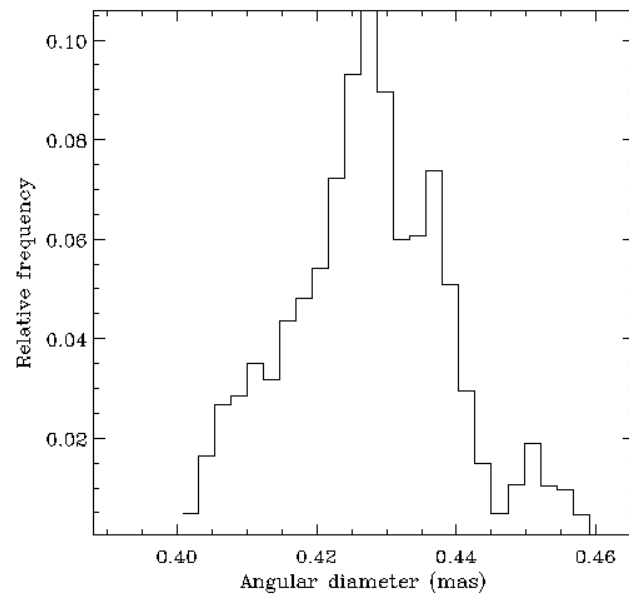
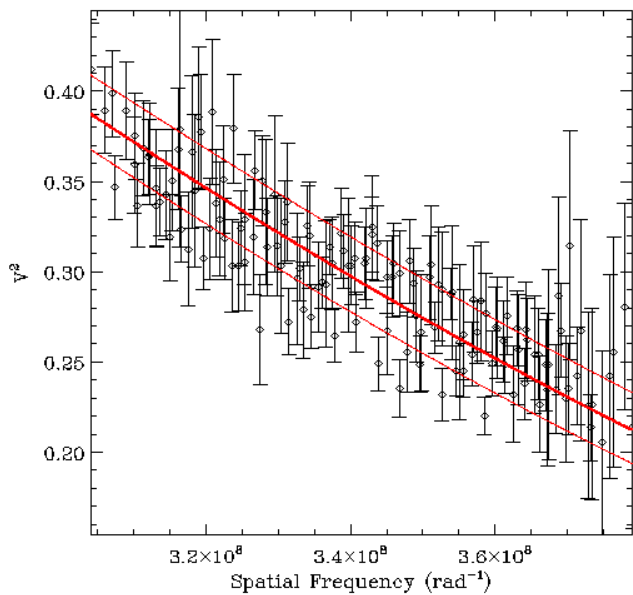
t0 Cor Coherent Exp Linwt PS CHI^2 SET SUSI TELS

LOAD CONFIG FILE: /home/jones/Reduce/Tutorial/H CALIBRATE RUN MC

```
(7): 180226_9_HD_154228.pav 58.9 min AZ: 124.3 EL: 58.4 HR: 192140 Dia: 0.215+/-0
(8): 180226_10_HD_154494.pav 65.1 min AZ: 127.0 EL: 58.5 HR: 192545 Dia: 0.405+/-
(9): 180226_11_HD_151862.pav 70.6 min AZ: 134.4 EL: 62.3 HR: 188893 Dia: 0.221+/-
(10): 180226_12_HD_154494.pav 76.5 min AZ: 131.1 EL: 60.4 HR: 192545 Dia: 0.405+/-
(11): 180226_13_HD_154228.pav 83.2 min AZ: 133.3 EL: 62.3 HR: 192140 Dia: 0.215+/-
(12): 180226_14_HD_154494.pav 89.1 min AZ: 136.2 EL: 62.3 HR: 192545 Dia: 0.405+/-
(13): 180226_15_HD_151862.pav 95.2 min AZ: 145.9 EL: 65.6 HR: 188893 Dia: 0.221+/-
```

Calibrating multiple brackets according to config file
diameter: 0.43094764 +/- 0.0010757730

fitted diameter: 0.43094764
Running MC simulation with 5041 iterations
mean & standard deviation: 0.42845301 +/- 0.011441837
median & credible (68.0%) regions: 0.42836435 + 0.010617739 - 0.011532481



Open + HD_154494.out
~/Reduce/Tutorial

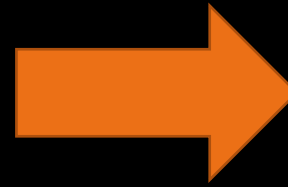
File Edit View Search Tools Documents Help

#B/lambda V2 sigma V2 U(meters) V(meters)					
3.1216229846537519E+08	0.3650367593299020	0.0280301418379996	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.1526127508244264E+08	0.3507122705500103	0.0283098875447656	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.1842239855029589E+08	0.3448872722565354	0.0421613783382009	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.2143885781504697E+08	0.3376139813915572	0.0297860843014034	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.2451301432238334E+08	0.3030838133648920	0.0247027862002748	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.2747327317857641E+08	0.2680874955030628	0.0306299173922027	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.3044394854892629E+08	0.3031276484163419	0.037426330631207	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.3346901431377918E+08	0.2787050410917881	0.0268407913375671	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.3654997803298259E+08	0.2929519748447164	0.0350465325063725	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.3968840350010312E+08	0.3034720643630747	0.0372731560881543	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.4293338478786540E+08	0.3206174573358216	0.0209612479263168	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.4599913931034386E+08	0.3046423266350891	0.0224016930815246	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.4912020272343224E+08	0.2754501669607446	0.0253287853843978	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.5209777374879199E+08	0.2930498249451070	0.0316878905542793	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.5502477258459967E+08	0.2609437529064093	0.0426719560160373	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.5805259299259210E+08	0.2837286517545103	0.0328547009778362	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.6107985981381220E+08	0.2615914122635504	0.0224890738540664	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.6405171051186830E+08	0.2379494077137772	0.0196700284015237	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.6696412419596320E+08	0.2484871247761987	0.0252814134840233	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.6986827509672722E+08	0.2295490341410229	0.0348586294380761	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.7287488157801473E+08	0.2258245677009491	0.0516590225260224	-1.4420171715340555E+02	-2.0139896494553477E+02	
3.7587372356946158E+08	0.2420411480255894	0.0563878833363131	-1.4420171715340555E+02	-2.0139896494553477E+02	

Convert to OIFITS!

pavo2T_to_oifits.py

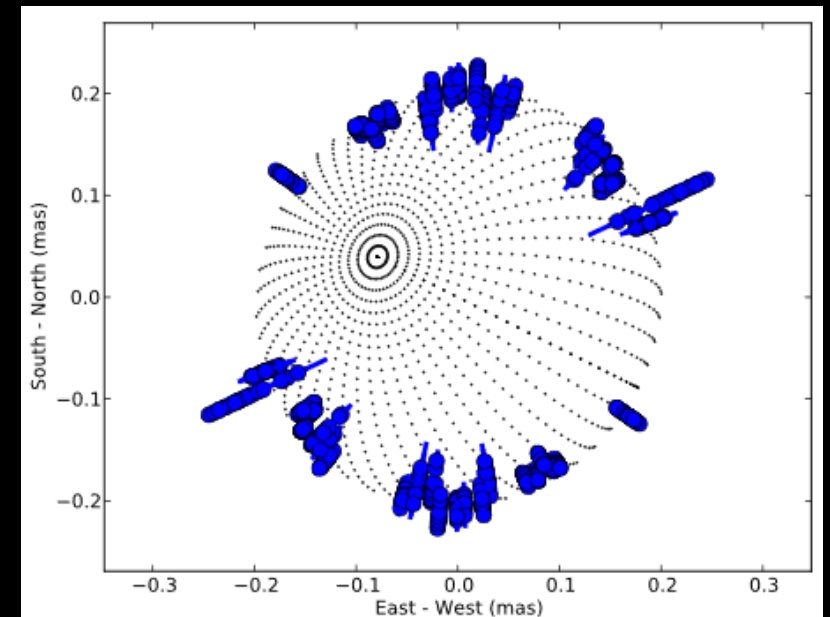
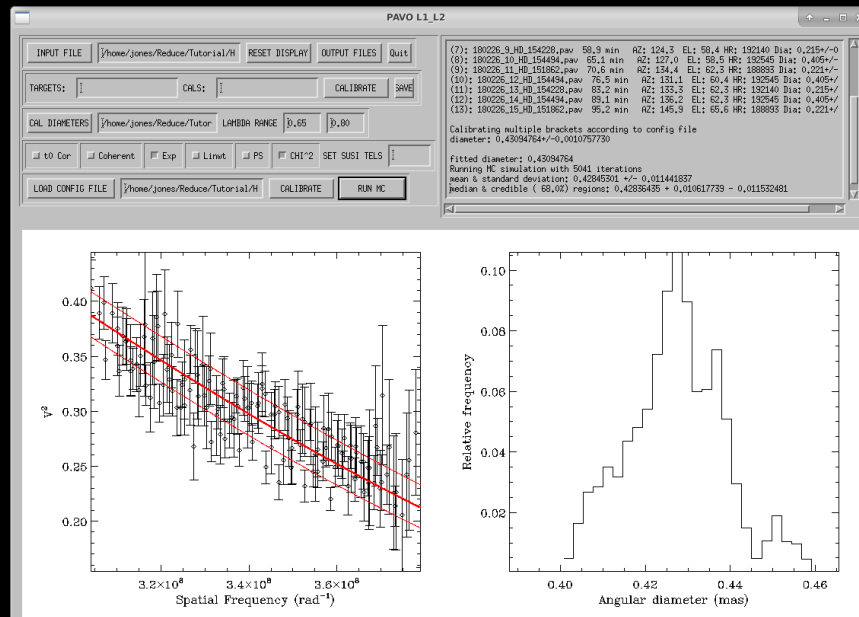
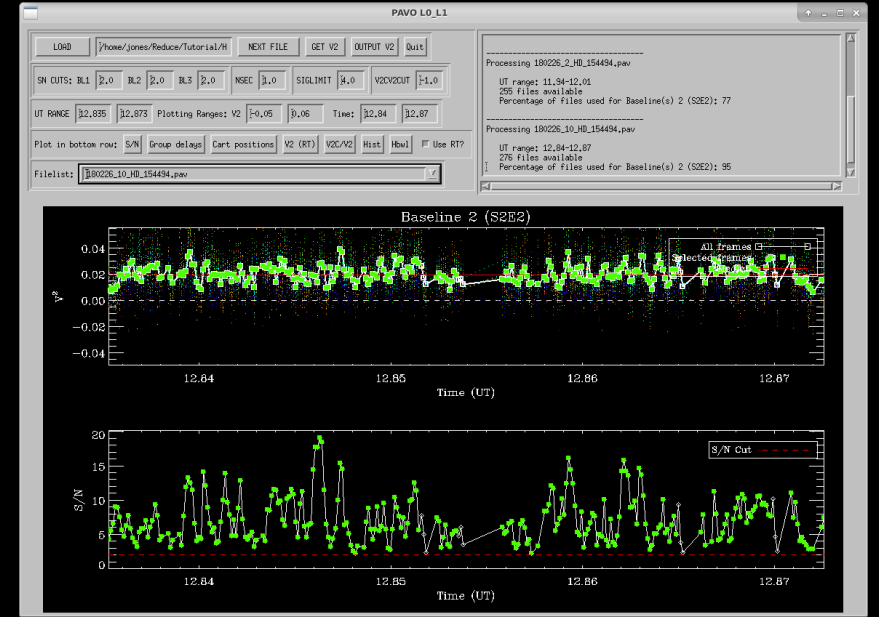
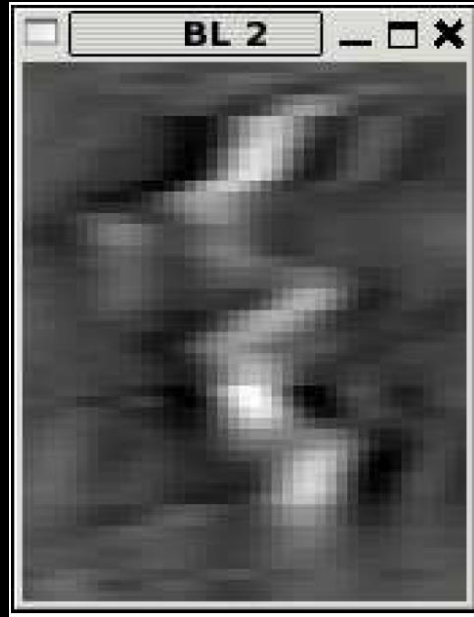
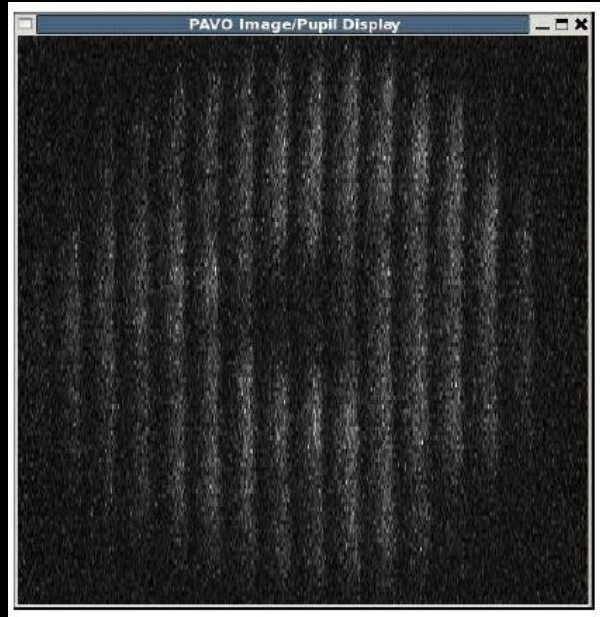
```
Open + HD_154494.out ~/Reduce/Tutorial
File Edit View Search Tools Documents Help
#B/lambd[V2|sigma V2|U(meters)]|V(meters)
3.1216229846537519E+08 0.3650367593299020 0.0280301418379996 -1.4420171715340555E+02 -2.0139896494553477E+02
3.1526127508244264E+08 0.3507122705500103 0.0283098875447656 -1.4420171715340555E+02 -2.0139896494553477E+02
3.1842239855029589E+08 0.3448872722565354 0.0421613783302009 -1.4420171715340555E+02 -2.0139896494553477E+02
3.2143885781504697E+08 0.3376139813915572 0.0297860843014034 -1.4420171715340555E+02 -2.0139896494553477E+02
3.2451301432238334E+08 0.3030838133648920 0.0247027862002748 -1.4420171715340555E+02 -2.0139896494553477E+02
3.2747327317857641E+08 0.2680874955030628 0.0306299173922027 -1.4420171715340555E+02 -2.0139896494553477E+02
3.3044394854892629E+08 0.3031276484163419 0.0374263330631207 -1.4420171715340555E+02 -2.0139896494553477E+02
3.3346901431377918E+08 0.2787050410917881 0.0268407913375671 -1.4420171715340555E+02 -2.0139896494553477E+02
3.3654997803298259E+08 0.2929519748447164 0.0350465325063725 -1.4420171715340555E+02 -2.0139896494553477E+02
3.3968840350010312E+08 0.3034720643630747 0.0372731560881543 -1.4420171715340555E+02 -2.0139896494553477E+02
3.4293338478786540E+08 0.3206174573358216 0.0209612479263168 -1.4420171715340555E+02 -2.0139896494553477E+02
3.4599913931034386E+08 0.3046423266350891 0.0224016930815246 -1.4420171715340555E+02 -2.0139896494553477E+02
3.4912020272343224E+08 0.2754501669607446 0.0253287853843978 -1.4420171715340555E+02 -2.0139896494553477E+02
3.5209777374879199E+08 0.2930498249451070 0.0316878905542793 -1.4420171715340555E+02 -2.0139896494553477E+02
3.5502477258459967E+08 0.2609437529064093 0.0426719560160373 -1.4420171715340555E+02 -2.0139896494553477E+02
3.5805259299259210E+08 0.2837286517545103 0.0328547009778362 -1.4420171715340555E+02 -2.0139896494553477E+02
3.6107985981381220E+08 0.2615914122635504 0.0224890738540664 -1.4420171715340555E+02 -2.0139896494553477E+02
3.6405171051186830E+08 0.2379494077137772 0.0196700284015237 -1.4420171715340555E+02 -2.0139896494553477E+02
3.6696412419596320E+08 0.2484871247761987 0.0252814134840233 -1.4420171715340555E+02 -2.0139896494553477E+02
3.6986827509672272E+08 0.2295490341410229 0.0348586294380761 -1.4420171715340555E+02 -2.0139896494553477E+02
3.7287488157801473E+08 0.2258245677009491 0.0516590225260224 -1.4420171715340555E+02 -2.0139896494553477E+02
3.7587372356946158E+08 0.2420411480255894 0.0563878833363131 -1.4420171715340555E+02 -2.0139896494553477E+02
3.7897916743004161E+08 0.2139367413603839 0.0559029446996681 -1.4420171715340555E+02 -2.0139896494553477E+02
3.1130241596219087E+08 0.3683647745967634 0.0265441776919170 -1.4014492074844185E+02 -2.0341466087784508E+02
3.1439285613592780E+08 0.3424486524654821 0.0248093244251379 -1.4014492074844185E+02 -2.0341466087784508E+02
3.1754527197068834E+08 0.3124753423632122 0.0313572223838612 -1.4014492074844185E+02 -2.0341466087784508E+02
3.2055342209446985E+08 0.3237586282592605 0.0282153585898922 -1.4014492074844185E+02 -2.0341466087784508E+02
3.2361911052796865E+08 0.3031421890789937 0.0256561977280287 -1.4014492074844185E+02 -2.0341466087784508E+02
3.2657121505288005E+08 0.3189557051918877 0.0317875217900599 -1.4014492074844185E+02 -2.0341466087784508E+02
3.2953370739861053E+08 0.3430826730210862 0.0436179656740030 -1.4014492074844185E+02 -2.0341466087784508E+02
3.3255044031502217E+08 0.2962235408044840 0.0363406795114474 -1.4014492074844185E+02 -2.0341466087784508E+02
3.3562291720923704E+08 0.2916136988118057 0.0247793788895639 -1.4014492074844185E+02 -2.0341466087784508E+02
3.3875269756719482E+08 0.3211882828659157 0.0249101189090031 -1.4014492074844185E+02 -2.0341466087784508E+02
3.4198874022705030E+08 0.3046244036882193 0.0201583839493771 -1.4014492074844185E+02 -2.0341466087784508E+02
3.4504604981980509E+08 0.2968818225241773 0.0201160380653580 -1.4014492074844185E+02 -2.0341466087784508E+02
3.4815851504925785E+08 0.305727676838750 0.023114567629965 -1.4014492074844185E+02 -2.0341466087784508E+02
```



OIFITS

pavo2T_to_oifits.py

Summary

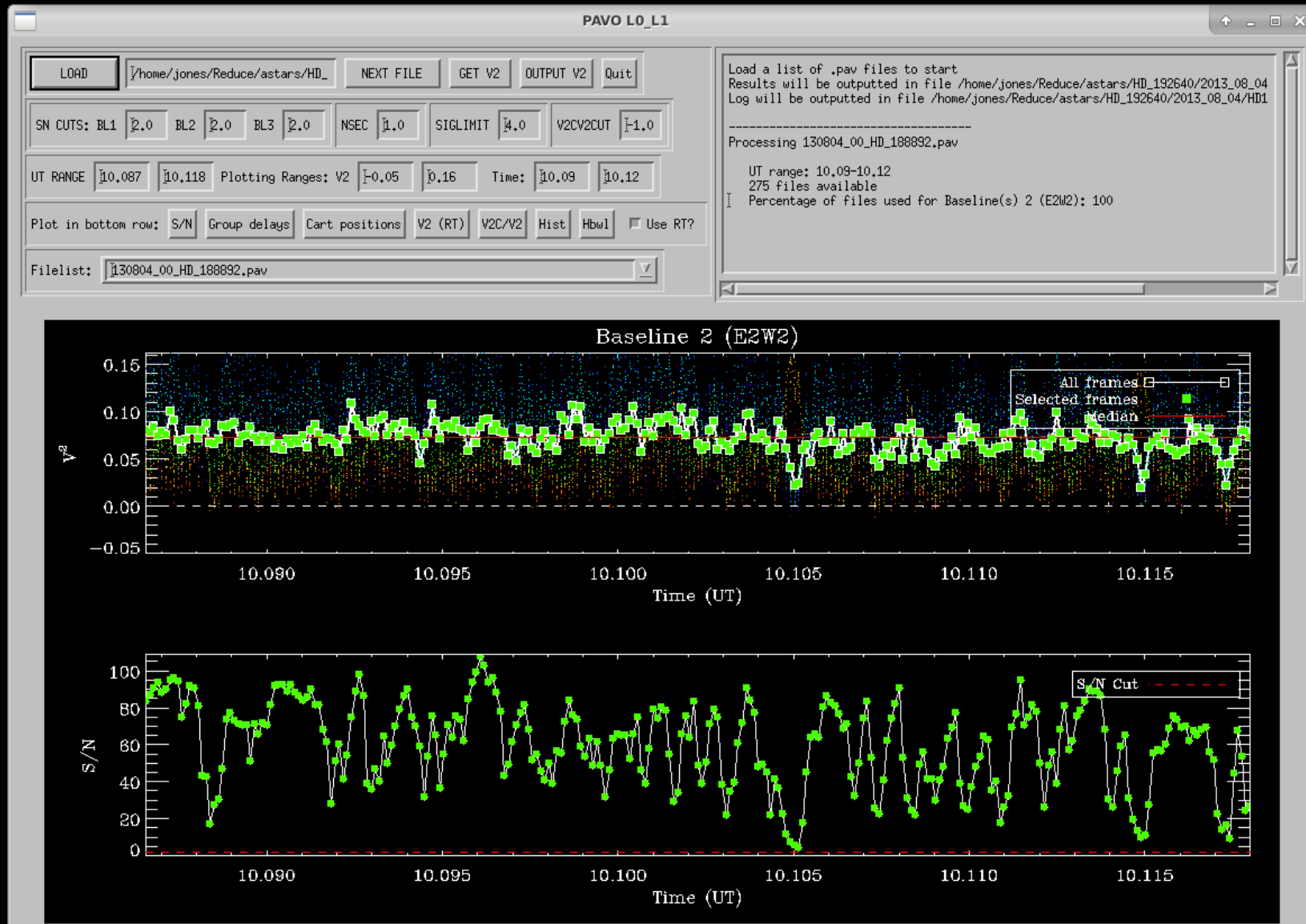


Bonus Slides

Reducing PAVO Data

I0_I1_gui.pro – Bad Data

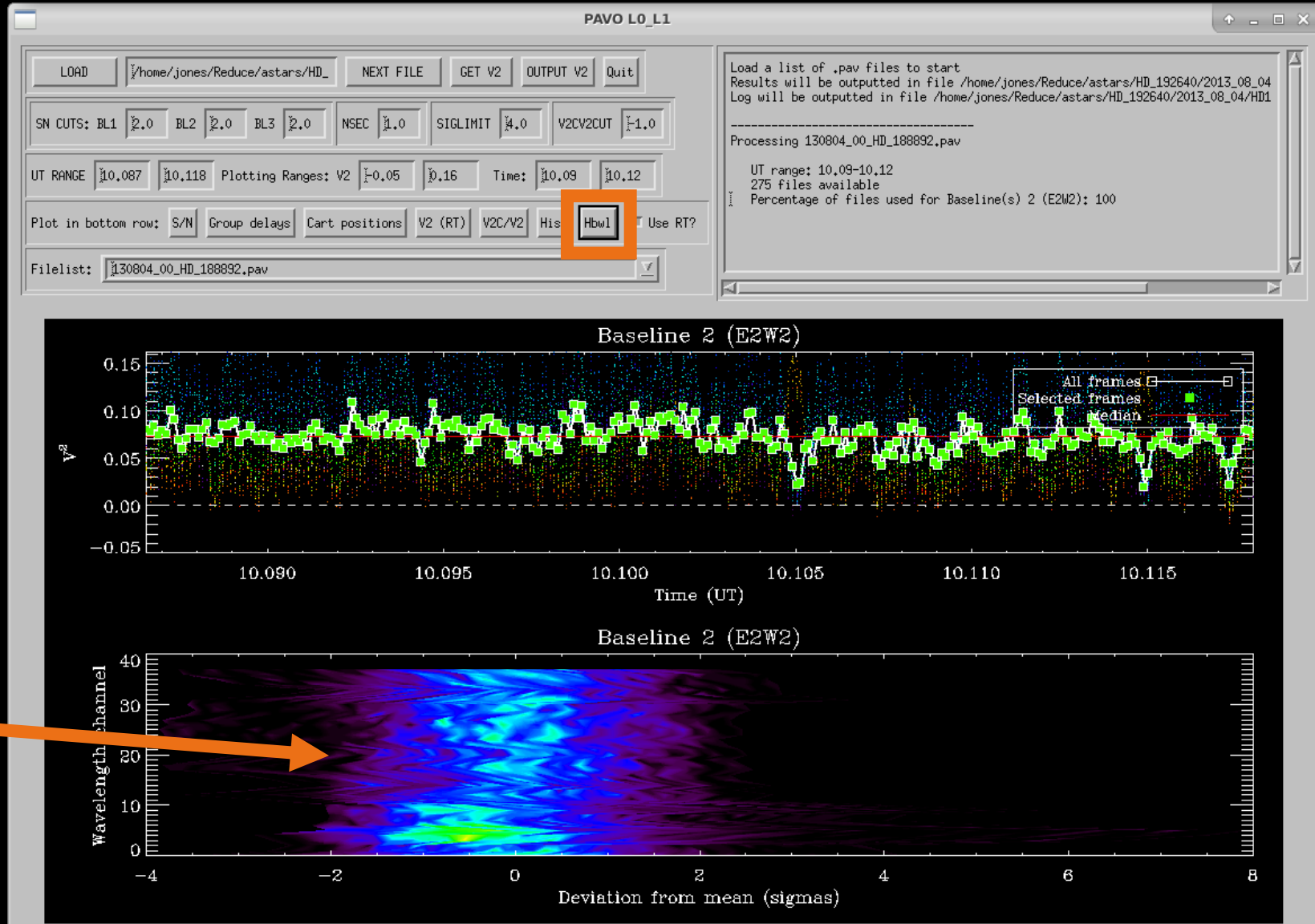
High dispersion causes wavelength on visibilities



Reducing PAVO Data

l0_l1_gui.pro – Bad Data

High dispersion causes wavelength on visibilities

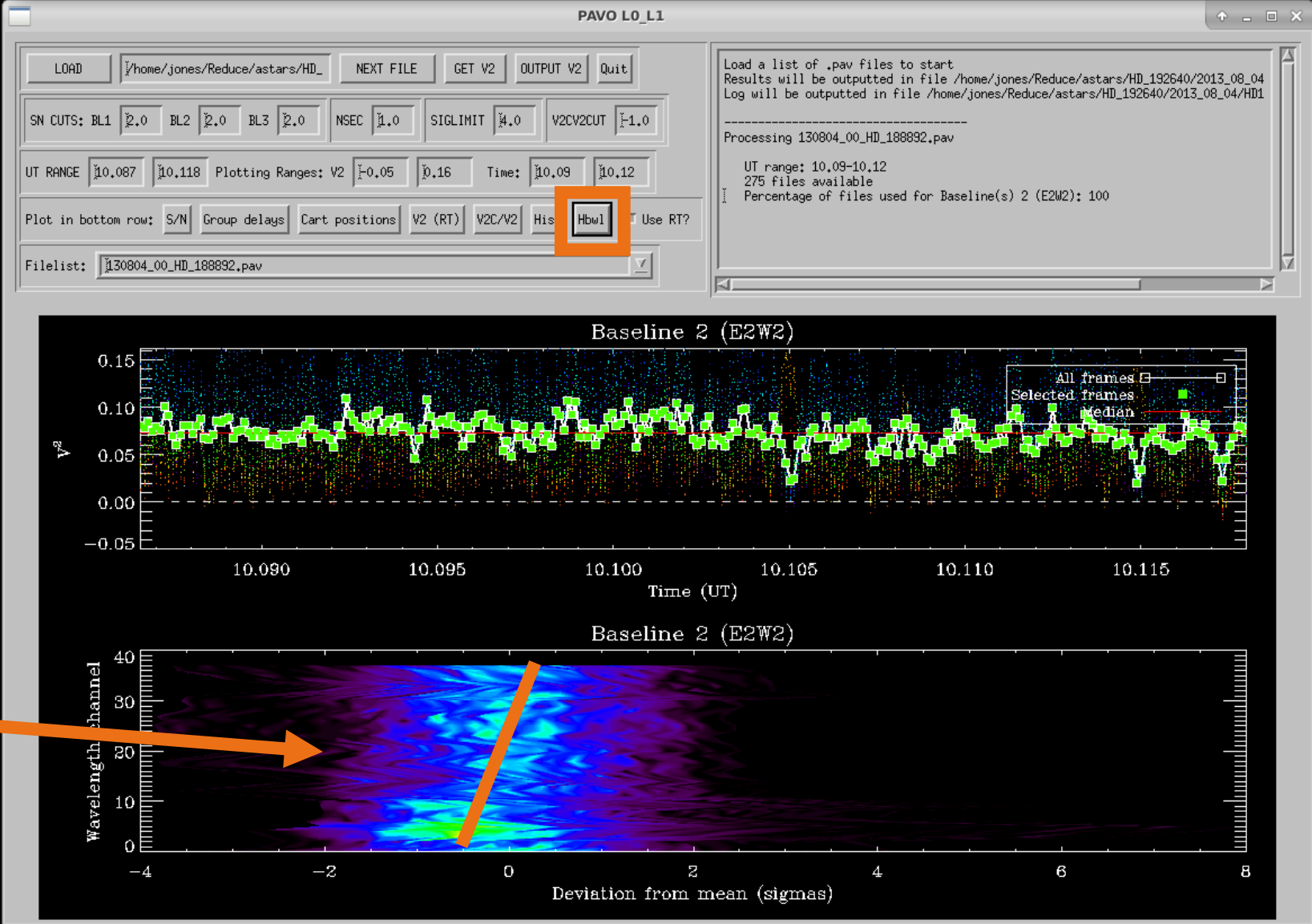


Wavelength trend

Reducing PAVO Data

l0_l1_gui.pro – Bad Data

High dispersion causes wavelength on visibilities



Wavelength trend