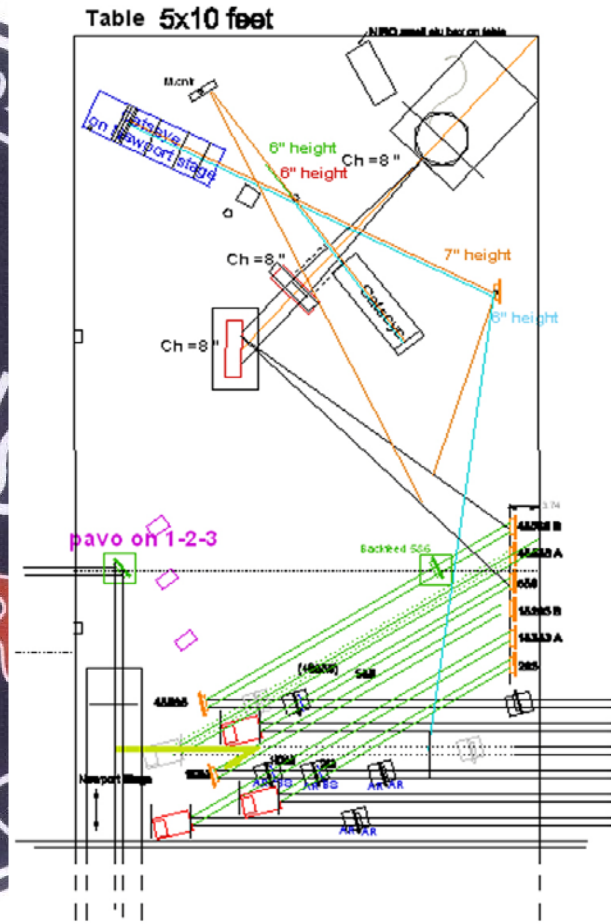
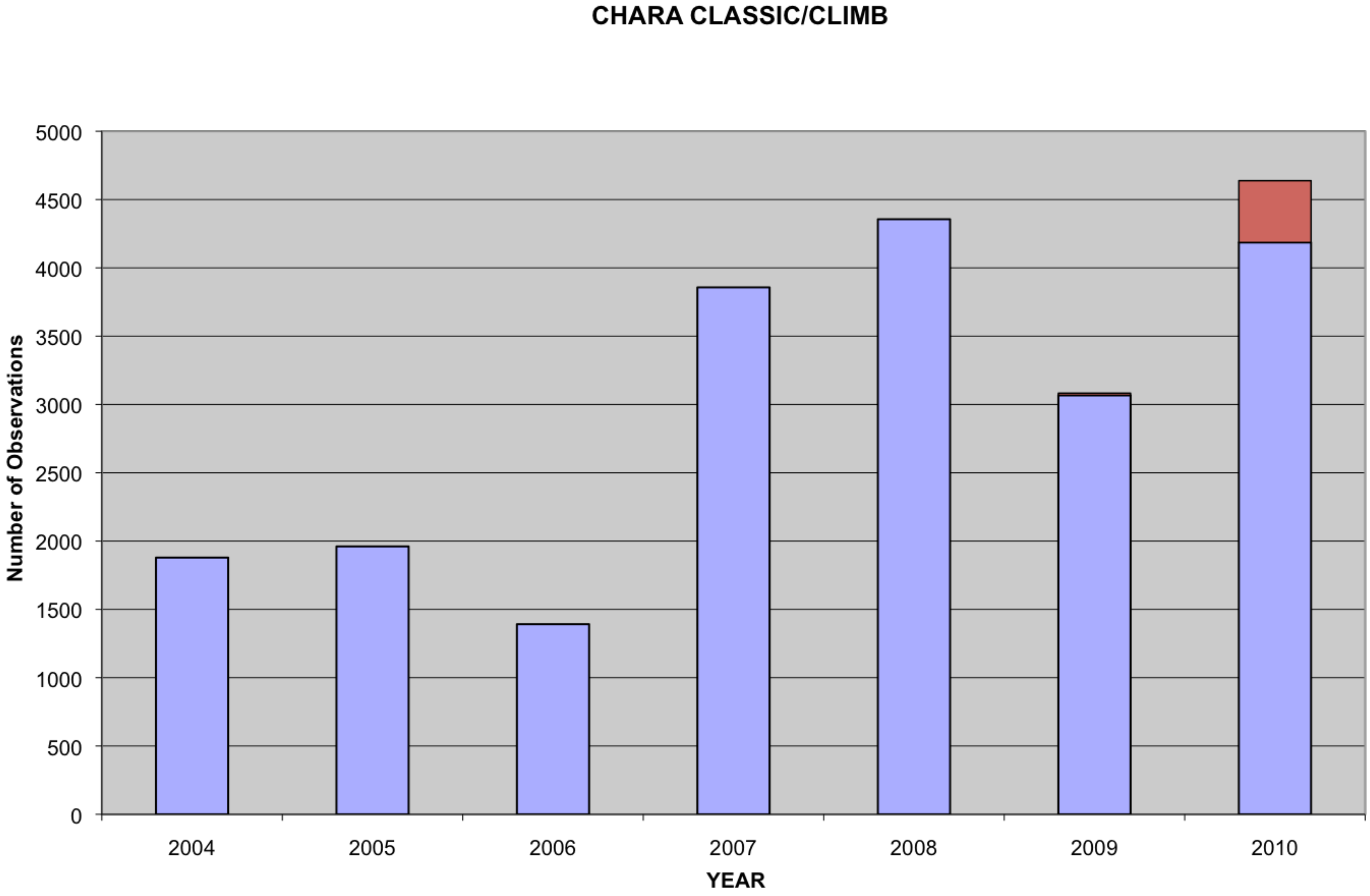
CHARA Classic/Climb Throughput.



Automated Data Reduction

- Automated editing – Fringe > 1.1 Noise Power
- Took approximately 180 minutes to crunch.
- V < 0 and V > 1 thrown away.
- Not reliable for science.
- K magnitudes extracted from 2MASS.
- Stars without 2MASS data thrown away.
- Includes both calibrators and science targets

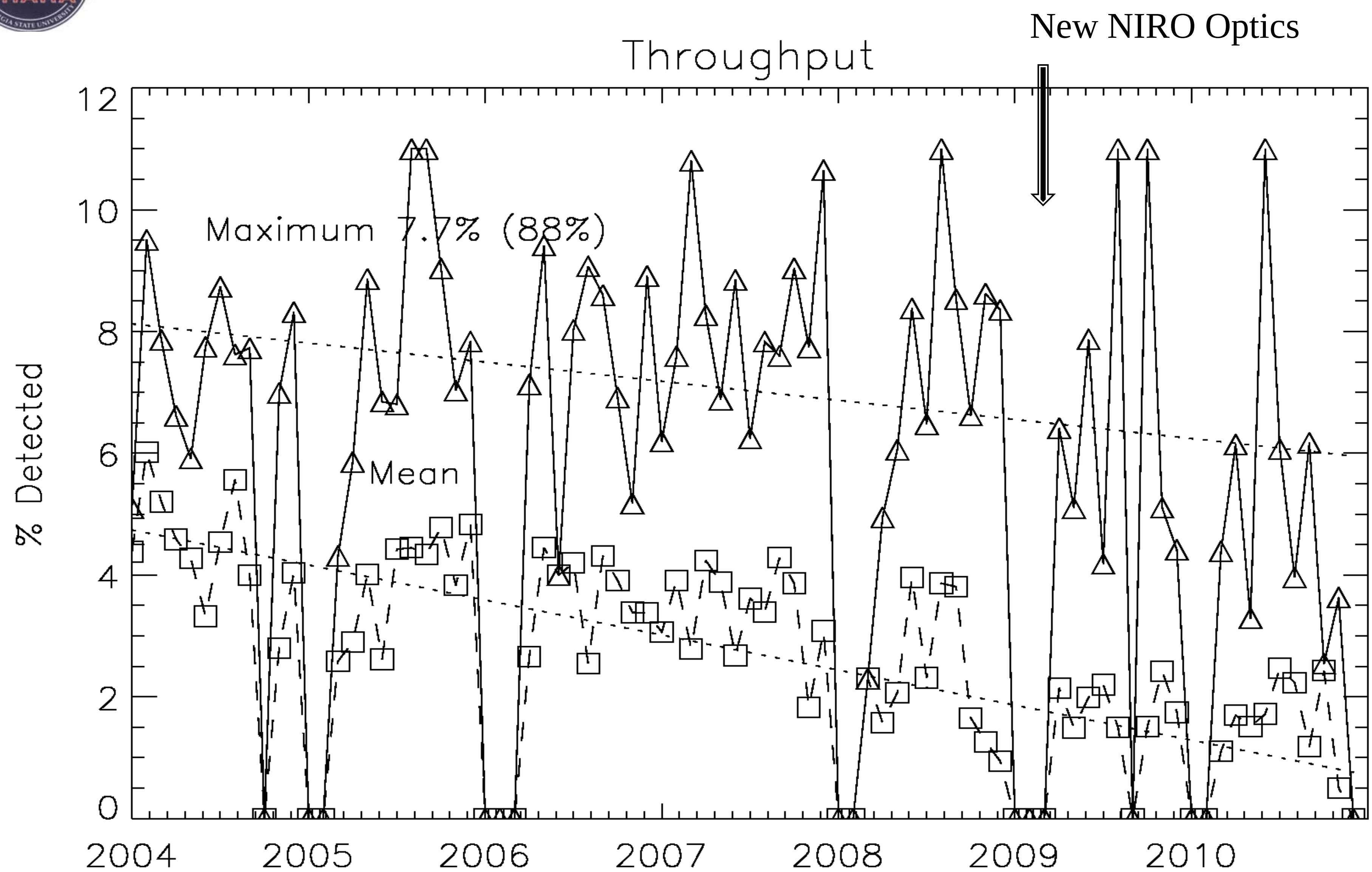
Amount of Data

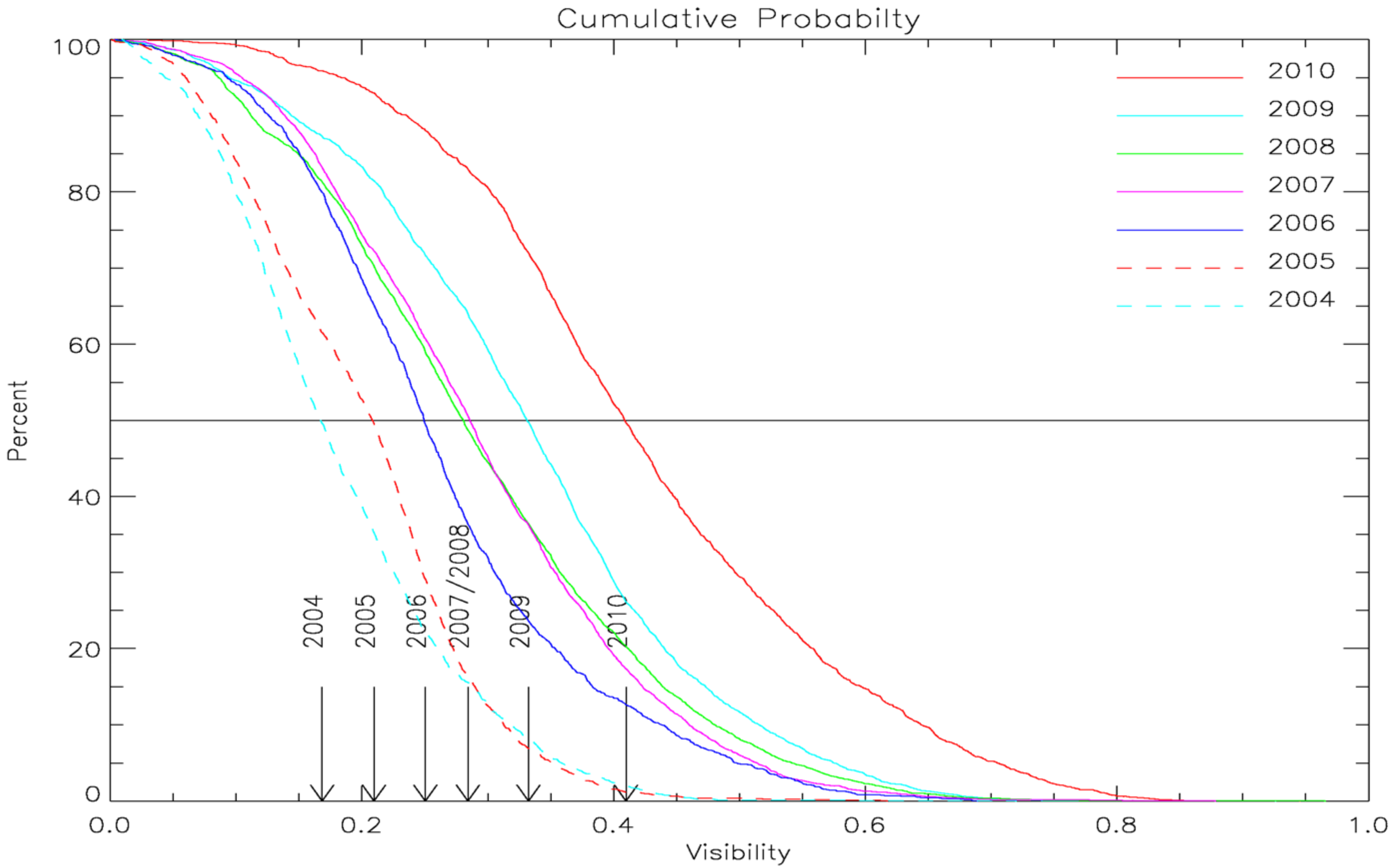


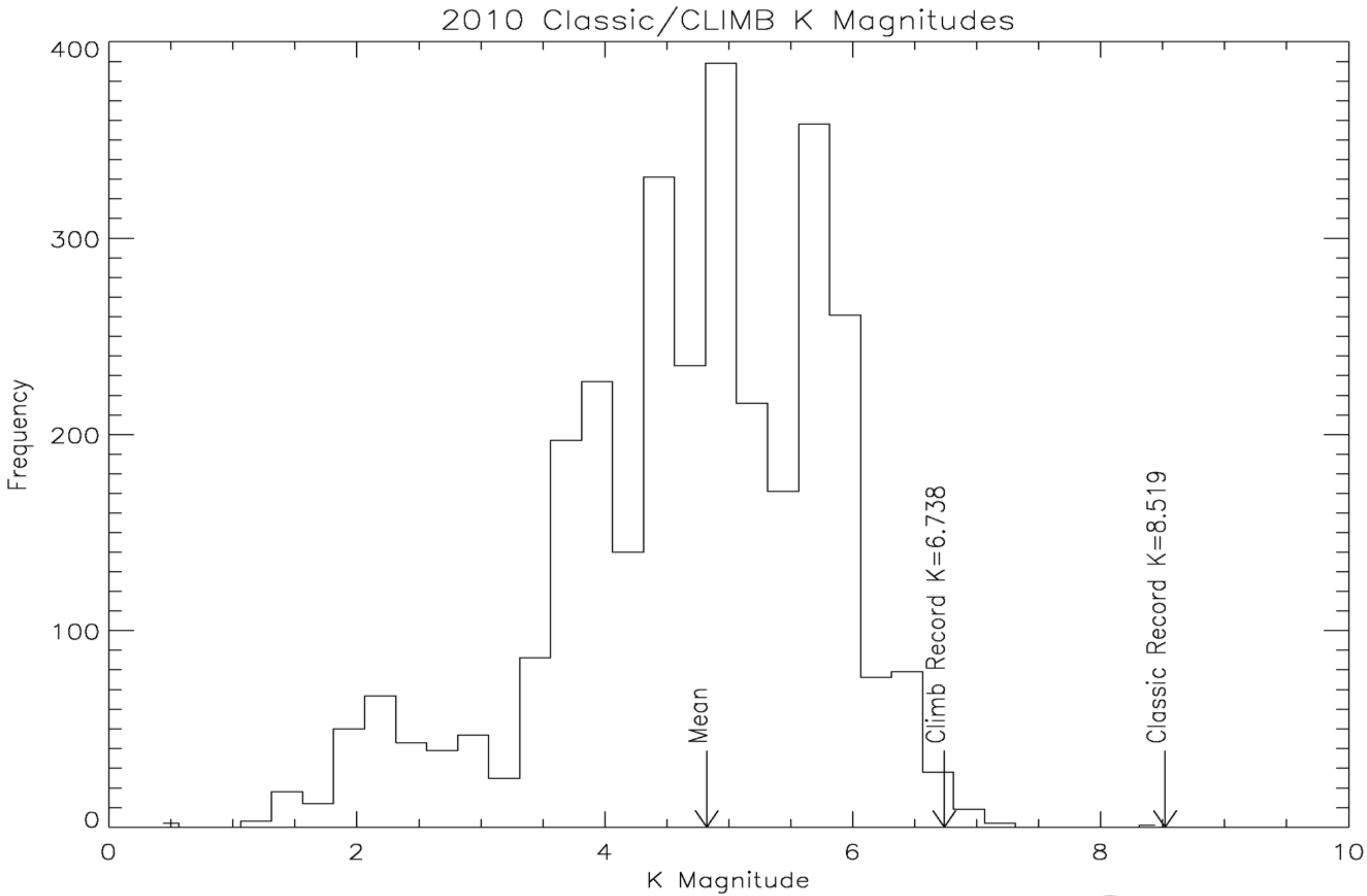
Georgia State University NSF NOAO l'Observatoire de Paris LESIA NExScI NASA Exoplanet Science Institute SUSI Observatoire de la CÔTE d'AZUR

K Mags are converted to a photon count.

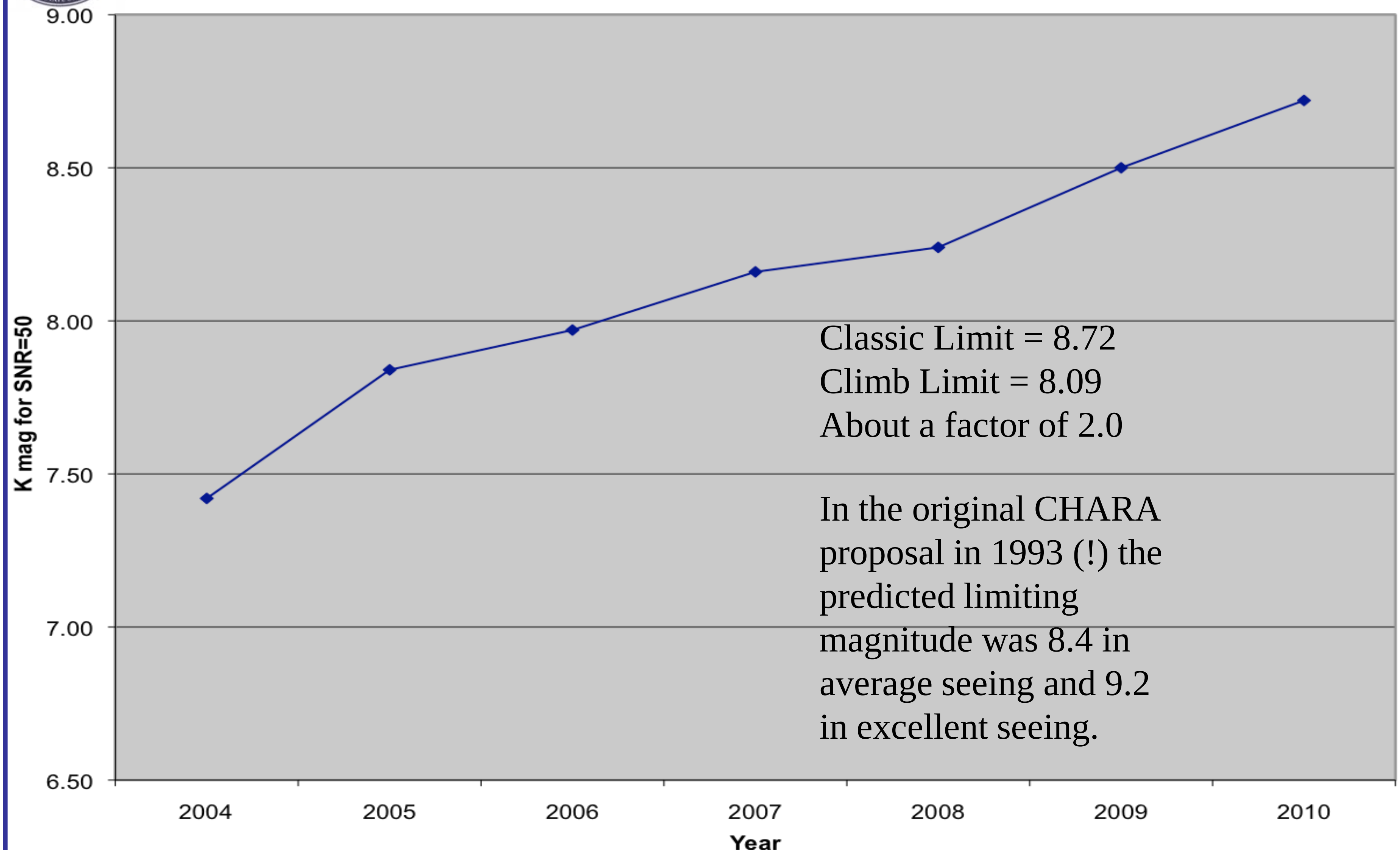
- In K band there are 4.31×10^9 Photons $m^{-2}\ s^{-1} um^{-1}$
- Two 1m telescopes: $2 \times \pi \times 0.25 = 1.57\ m^2$
- All data calibrated to 1 second.
- This assumes the NIRO readout mode behaves.
- K band is 0.35 um wide.
- All of this results in $Nph = 2.37 \times 10^{(9- M/2.5)}$
- Camera Gain = 0.3, DQE = 60%.


New NIRO Optics
Throughput
Maximum 7.7% (88%)
Mean
% Detected
0
2
4
6
8
10
12
2004
2005
2006
2007
2008
2009
2010


Cumulative Probabilty
Percent
Visibility
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
1.0
2010
2009
2008
2007
2006
2005
2004
2004
2005
2006
2007/2008
2009
2010


2010 Classic/CLIMB K Magnitudes
Frequency
K Magnitude
0
100
200
300
400
0
2
4
6
8
10
Mean
Climb Record K=6.738
Classic Record K=8.519

SNR ~ V * sqrt(N)

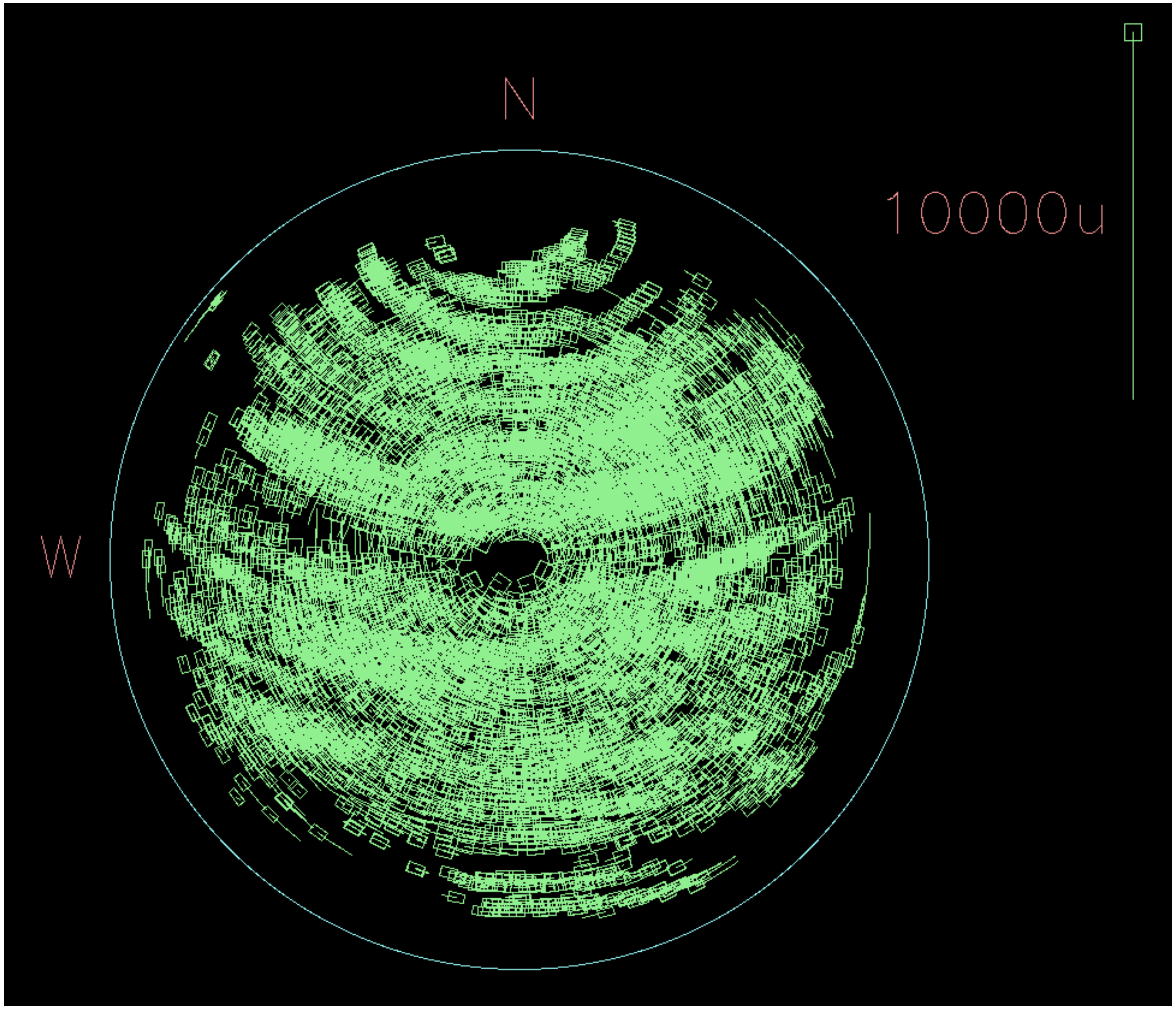


Georgia State University · NSF · NOAO · l'Observatoire de Paris · LESIA · The University of Michigan 1817 · NExScI NASA Exoplanet Science Institute · SUSI Sydney University Stellar Interferometer Australia · Observatoire de la Côte d'Azur

New Baseline Solution

- The system records OPLE demand positions and current Alt/Az when fringes are found.
- This is automated for all beam combiners.
- Data from multiple baselines improves the solution.
- The demand position is better for modeling than the measured position.
- The height of a scope is degenerate with its internal path.
- We use a different internal path for each POP configuration to solve for telescope positions.
- We then do a separate solution for internal path.

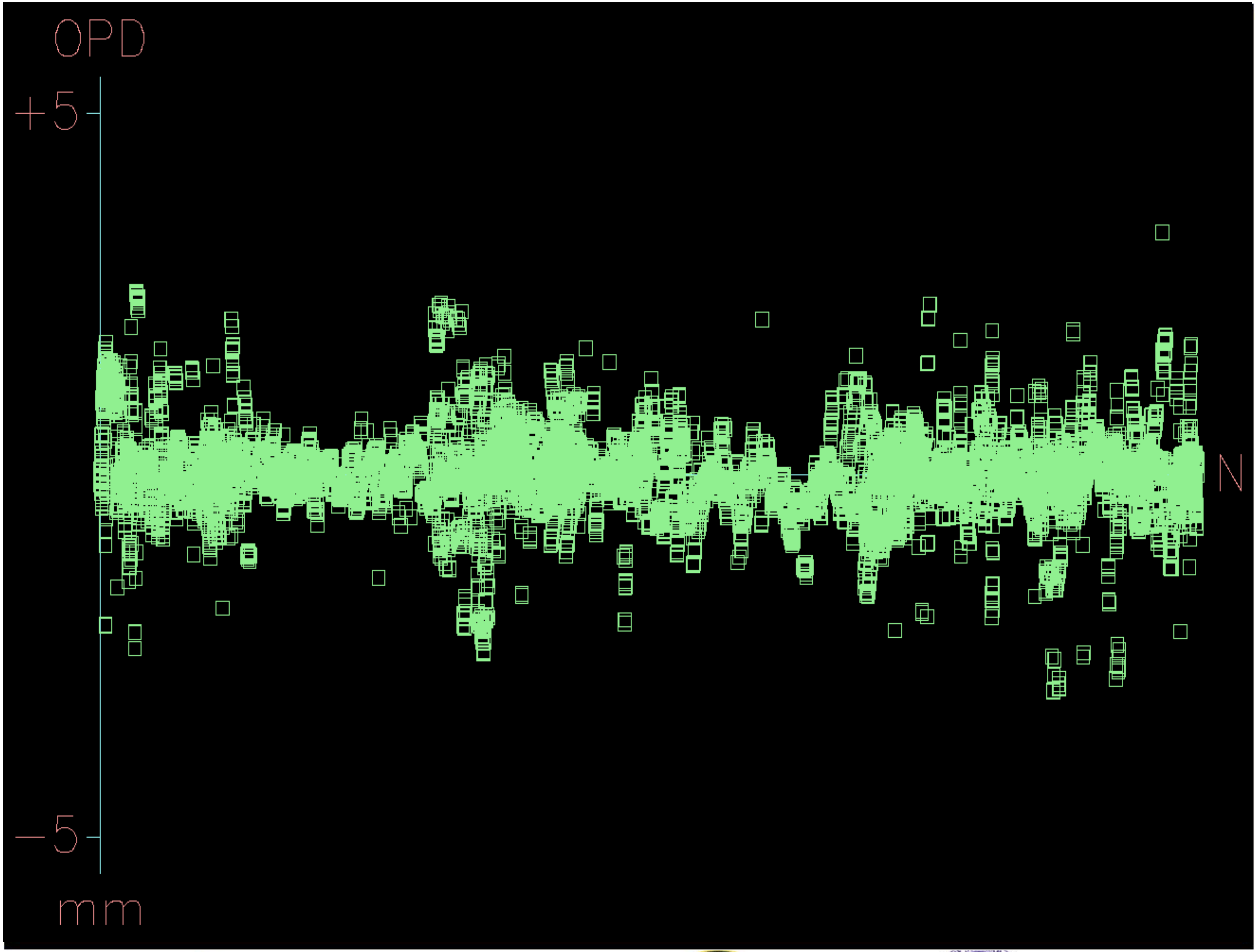
Sky Coverage



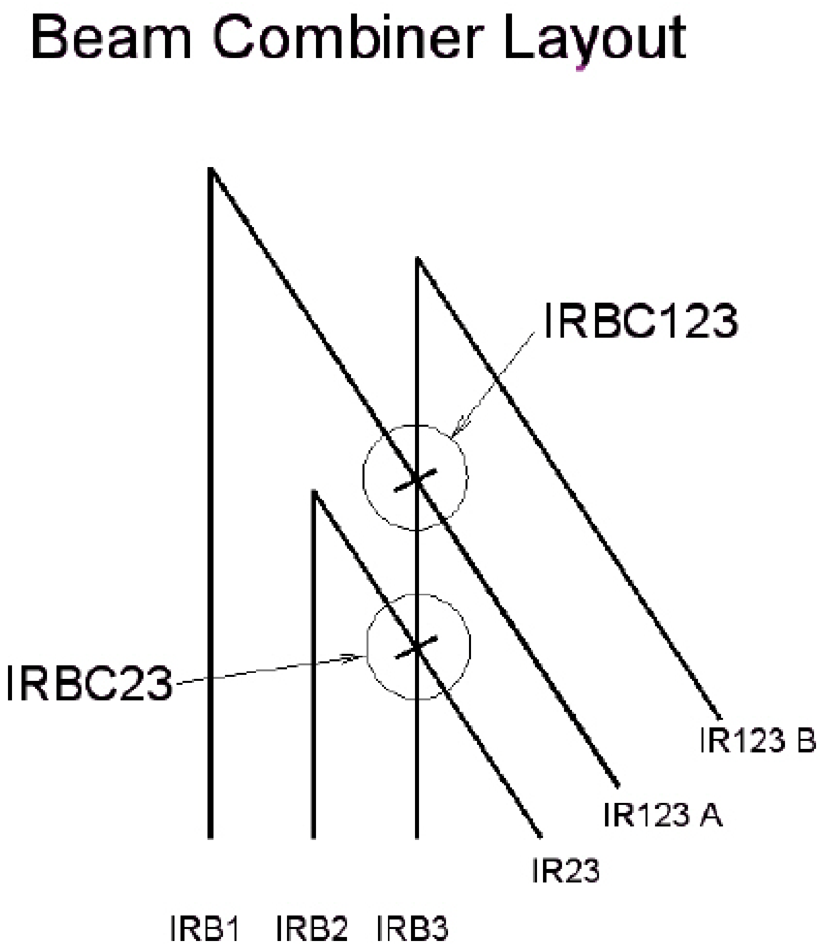
```
CHARA ALL                                   S1-E1.A   -94632983.492    360.6224  /S1E1P41B13    S1-W1.A   -7832752.025    342.1828  /S1W1P12B13
18474 1480.192
=S1.X
=S1.Y
=S1.Z
 S2.X        +574
 S2.Y       -3357
 S2.Z         +63
 S1-E2.A   -18999
 E1.X      -12533
 E1.Y      -30593
 E1.Z        -590
 E2.X       -7039
 E2.Y      -26971
 E2.Z        -280
 S1-S2.A   -17511
 W1.X      +17507
 W1.Y      -21631
 W1.Z       -1079
 W2.X       +6909
 W2.Y      -19933
 W2.Z         +46
 S1-E1.A   -12792
 S2-E1.A    +4717
 S1-S2.A     +447
 S2-E1.A    -5884
 S2-E2.A    -4778
 E1-E2.A    +1105
 S1-E1.A   -12773
 S2-E2.A    -5163
 S2-E2.A    -5120
 S1-S2.A     +490
 S1-E2.A    -4630
 S1-S2.A    -6864
 S1-E1.A    -2146
 S2-E2.A    +2147
 S2-E2.A    +5801
 S2-W2.A    -1011
 S2-E2.A    -8821
 S2-W2.A    -5014
 E2-W2.A    +3807
 W1-W2.A    +3531
 S1-W2.A   -11839
 S1-E2.A   -15667
 S2-W1.A   -15537
 E2-W1.A    -7014
 S1-E1.A    -9439
 S1-W1.A   -15067
 S1-W1.A    -4419
 S1-E1.A    +1530
 E1-W1.A    +8372
 S1-E1.A   -12273
 E2-W1.A   -14048
 E2-W1.A   +11267
 W1-W2.A    -7460
 S1-W1.A    -4377
 S2-W1.A    -1234
 W1-W2.A    -3779
```

```
# For telescope S1: value stddev delta (total delta 0.000)
XOFFSET          0.000      0.000      0.000
YOFFSET          0.000      0.000      0.000
ZOFFSET          0.000      0.000      0.000
LIGHT            0.000      0.000      0.000
# For telescope S2: value stddev delta (total delta 6598.835)
XOFFSET   -5746341.257    123.735   -513.180
YOFFSET   33578621.611    195.080   2020.025
ZOFFSET     630458.034    350.541   6261.052
LIGHT      4098831.159   1955.365   7148.174
# For telescope E1: value stddev delta (total delta 1894.913)
XOFFSET  125333157.981     83.169    831.838
YOFFSET  305931610.441    135.671   1022.296
ZOFFSET   -5908374.246    237.406  -1361.489
LIGHT     11256822.564    827.802   2224.968
# For telescope E2: value stddev delta (total delta 3544.374)
XOFFSET   70395768.413    108.519    838.705
YOFFSET  269712822.172    151.411    450.086
ZOFFSET   -2800157.610    323.458   3414.174
LIGHT     22694490.507   1723.897   6082.138
# For telescope W1: value stddev delta (total delta 2113.392)
XOFFSET -175072619.065    108.262   -713.146
YOFFSET  216318449.259    132.974   1985.240
ZOFFSET  -10790982.114    263.378   -129.121
LIGHT     27286241.250   2112.102    860.303
# For telescope W2: value stddev delta (total delta 3794.207)
XOFFSET  -69092733.004    110.879   -849.792
YOFFSET  199332847.726    151.749   1885.509
ZOFFSET     464155.030    299.321   3180.993
LIGHT    -10871696.907   1702.549   3184.350
```

```
06  /E1W1P32B23
78  /E2W1P11B32
03  /E2W2P15B31
03  /W1W2P15B21
09  /W1W2P13B56
08  /E1E2P12B65
41  /S1W1P31B23
78  /W1W2P15B31
13  /S1E1P44B13
07  /S1W1P42B12
44  /E1W1P42B32
55  /S2W1P12B12
18  /W1W2P25B23
06  /S2E1P44B13
40  /S2W1P42B12
74  /S2E2P41B13
13  /S2W2P45B12
56  /E1W2P45B32
37  /S1E2P41B13
44  /E2W1P12B32
39  /S1S2P45B12
07  /S1W2P45B13
03  /S2W2P55B23
33  /S1E2P25B43
03  /S1W1P21B41
14  /S1W2P25B42
32  /E2W1P51B31
55  /E2W2P55B32
55  /W1W2P15B12
00  /S2E1P41B34
23  /S2W1P41B31
03  /S2W2P45B32
59  /E1W1P11B41
18  /E1W2P15B42
44  /S2E1P24B34
03  /S2W1P21B31
05  /S2W2P25B32
05  /E1W1P41B41
53  /E1W2P45B42
22  /S1E2P31B43
05  /S1W1P31B41
41  /S1W2P35B42
17  /E2W1P11B31
```


OPD
+5
-5
mm
N

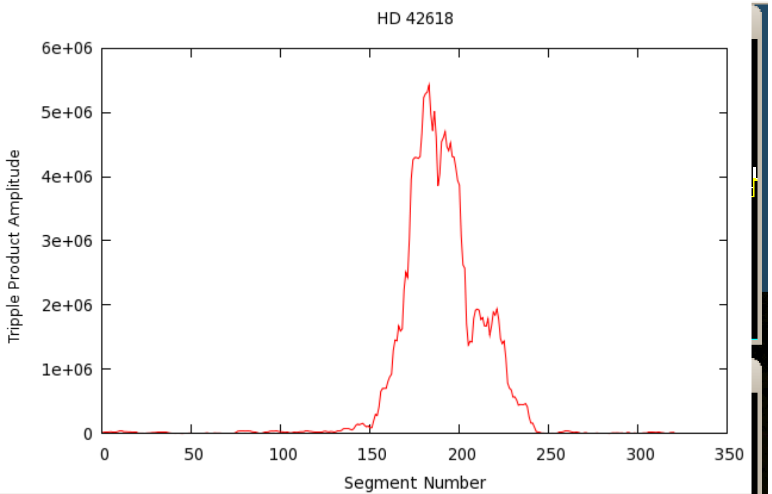
CLIMB Update

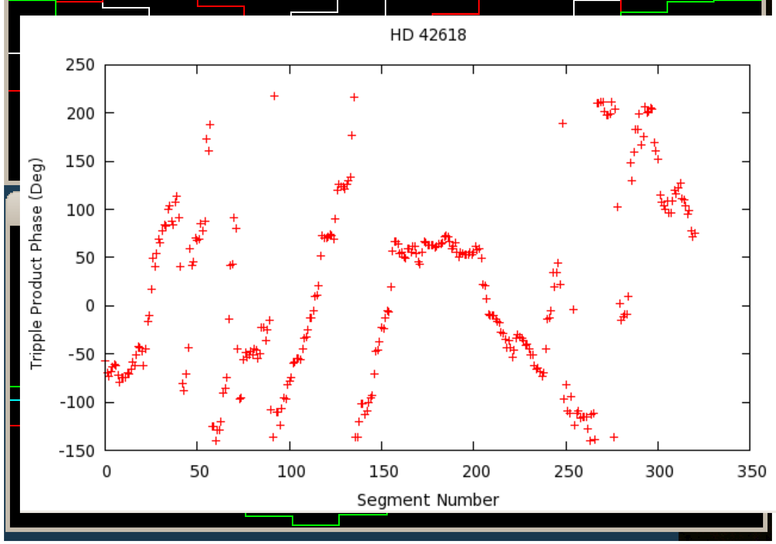


- Despite the lack of a working data reduction pipeline CLIMB has become very popular.
- There were only 2-3 CLASSIC proposals this season.
- Do we turn CLASSIC into a second CLIMB this winter?
- With the addition of one kinematic mount we could have both.
- Nearly 500 data files in 2010.

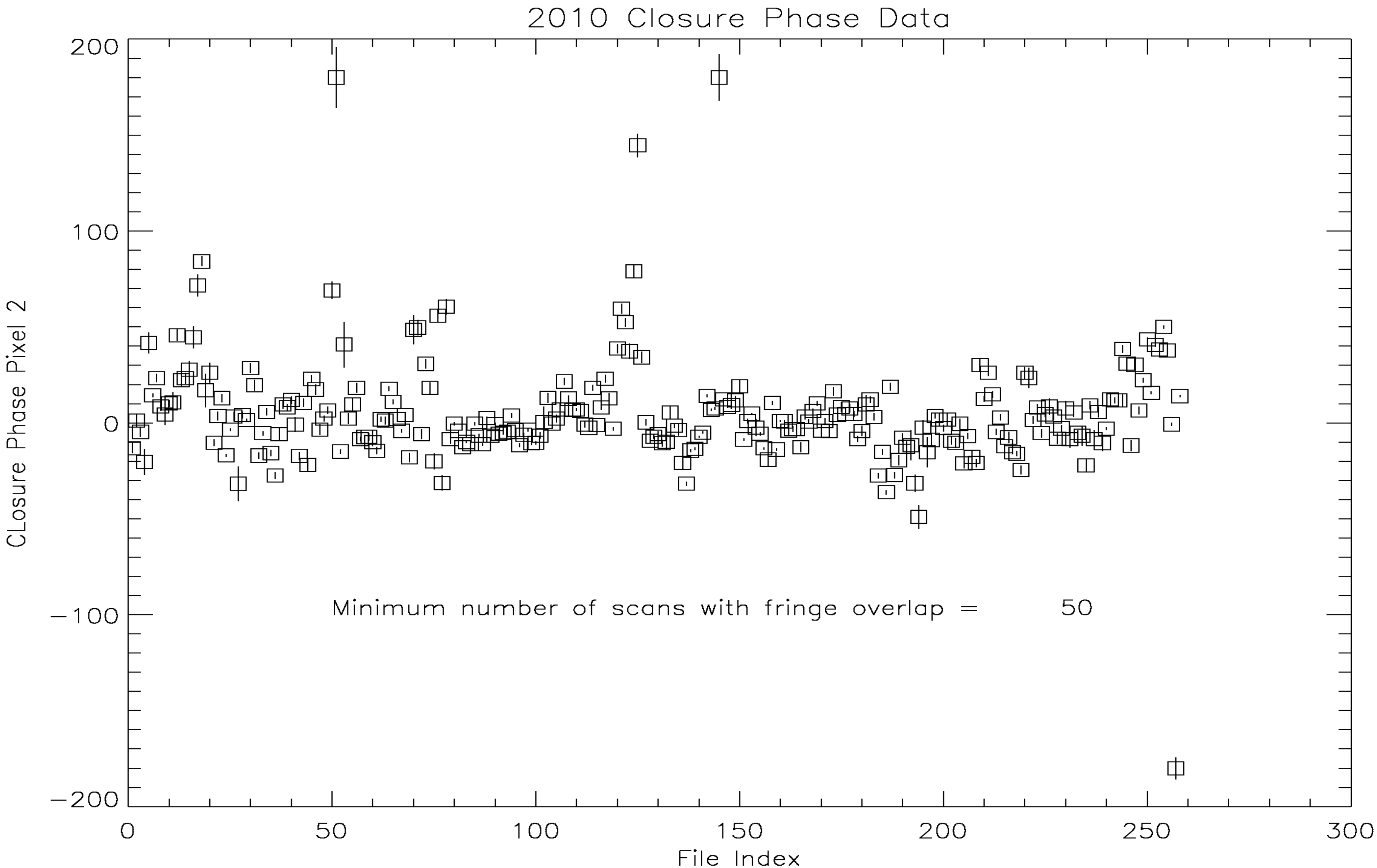
by Judit Sturmann July 9, 2009

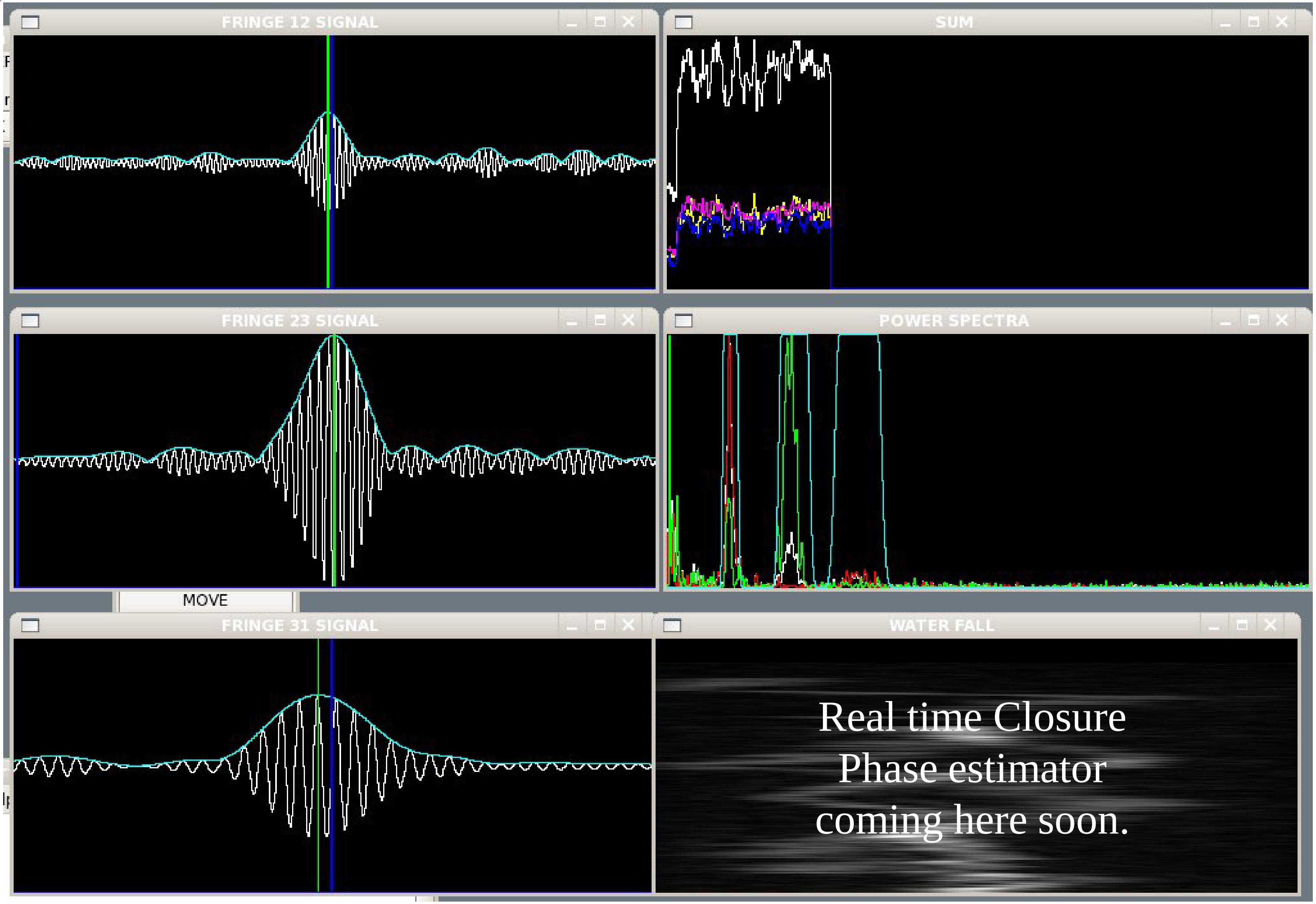
Redclimb Example Output





- Each scan is broken up into segments such that the segment length is one wave of the lowest frequency fringe. This happens to be the beam 3 and 1 baseline.
- This means the other two fringes will have two (beams 2&3) and three fringes (beams 1&2) in the segment.
- A DFT of the segment will have the three baselines represented in the 1, 2 and 3 cycle bins. In fact you only need to calculate the DFT for these three frequencies.
- It's important that the frequencies close, that is you need to use the frequencies $-f_{12}$, f_{23} & f_{31}.
- The triple product of the DFT values for these frequencies contains the closure phase signal weighted by the triple amplitude.
- The mean of this triple amplitude is calculated across all segments in all scans.


2010 Closure Phase Data
CLosure Phase Pixel 2
File Index
Minimum number of scans with fringe overlap = 50
200
100
0
−100
−200
0
50
100
150
200
250
300


FRINGE 12 SIGNAL
SUM
FRINGE 23 SIGNAL
POWER SPECTRA
MOVE
FRINGE 31 SIGNAL
WATER FALL
Real time Closure
Phase estimator
coming here soon.

What we have learned.

- This only works if $t_{seg} < t_0$ so you need to use as few samples per fringe as possible (3) and use the fastest and shortest scan possible.
- Baselines 23 and 31 have shorter scans and more samples per fringe and should normally be used for group delay tracking. Use beam 3 as reference when possible.
- CLIMB fringe amplitudes do not calibrate as well as CLASSIC. Use CLASSIC for the best precision fringe amplitudes.
- Only scans with fringe overlap count. The defaults for scan numbers and aceptance may have to change.