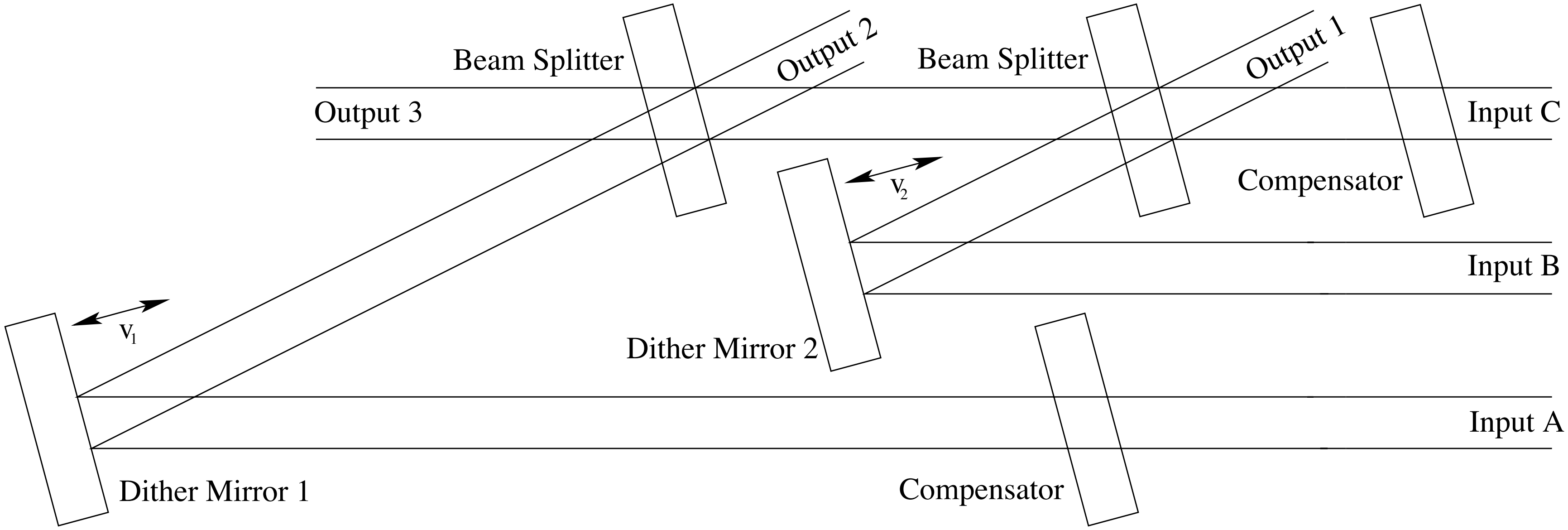
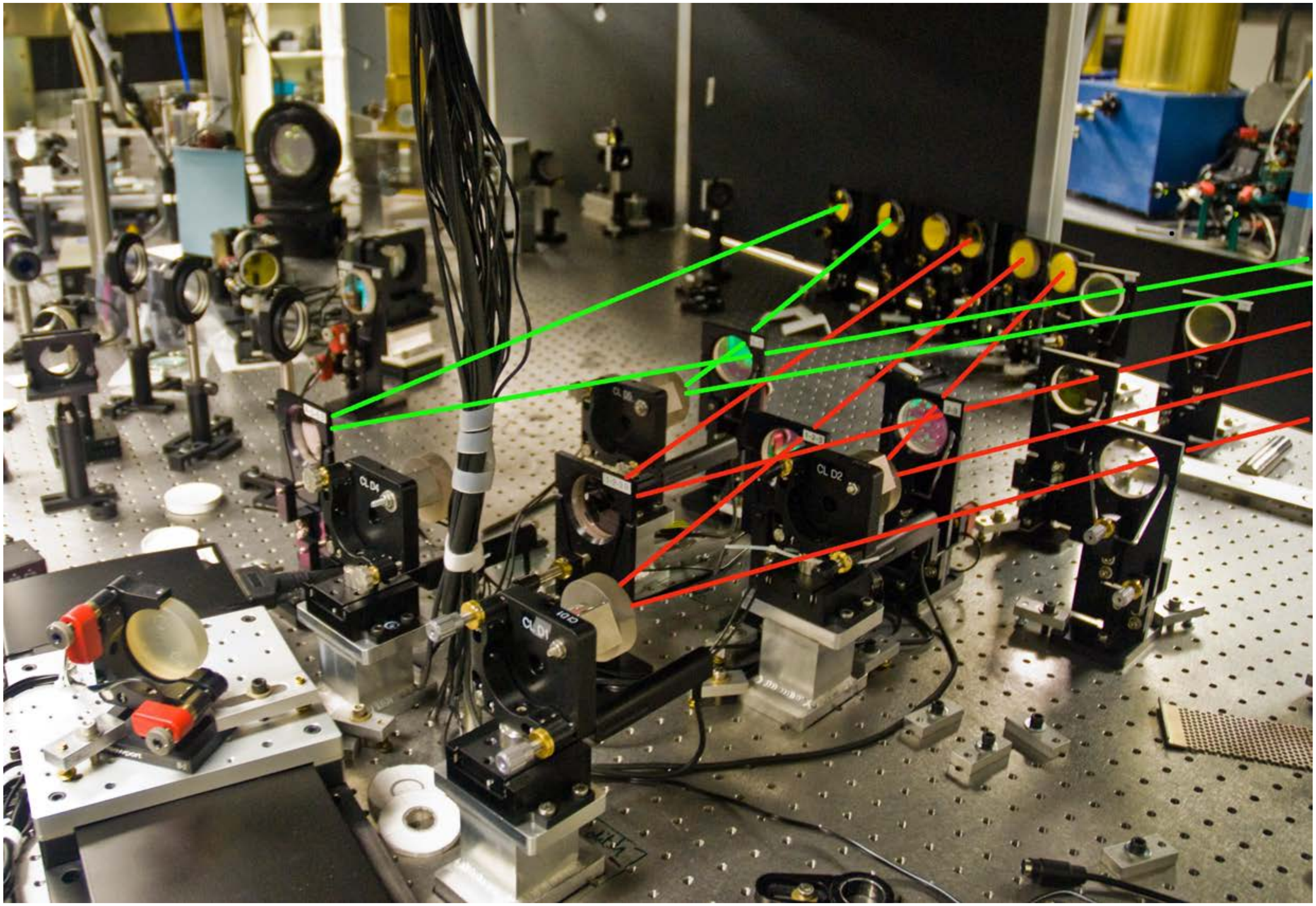
CHARA Classic/Climb Numbers.

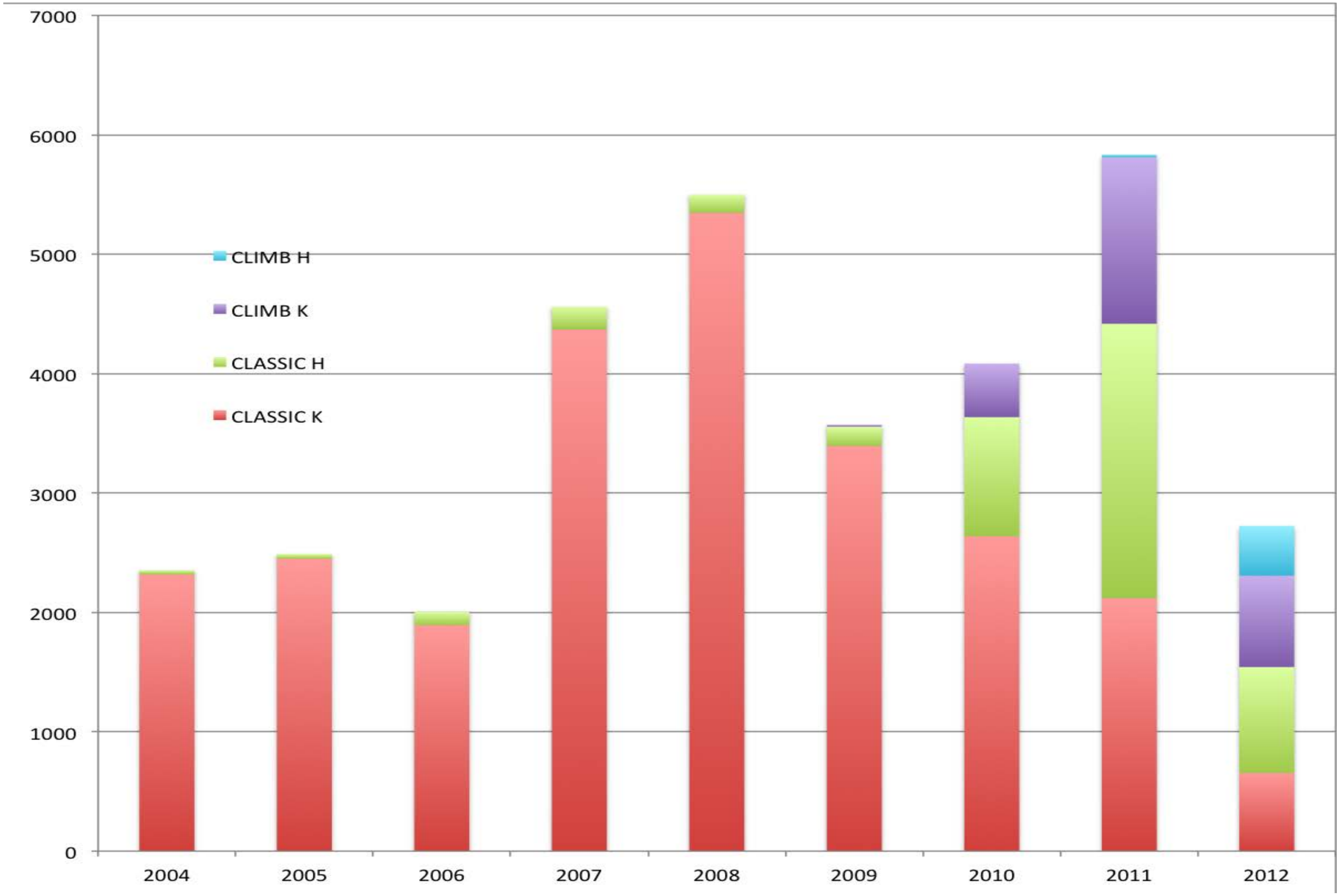

Beam Splitter
Output 2
Beam Splitter
Output 1
Output 3
Input C
v_2
Compensator
Input B
v_1
Dither Mirror 2
Input A
Dither Mirror 1
Compensator


CL D1
CL D2
CL D1

Automated Data Reduction

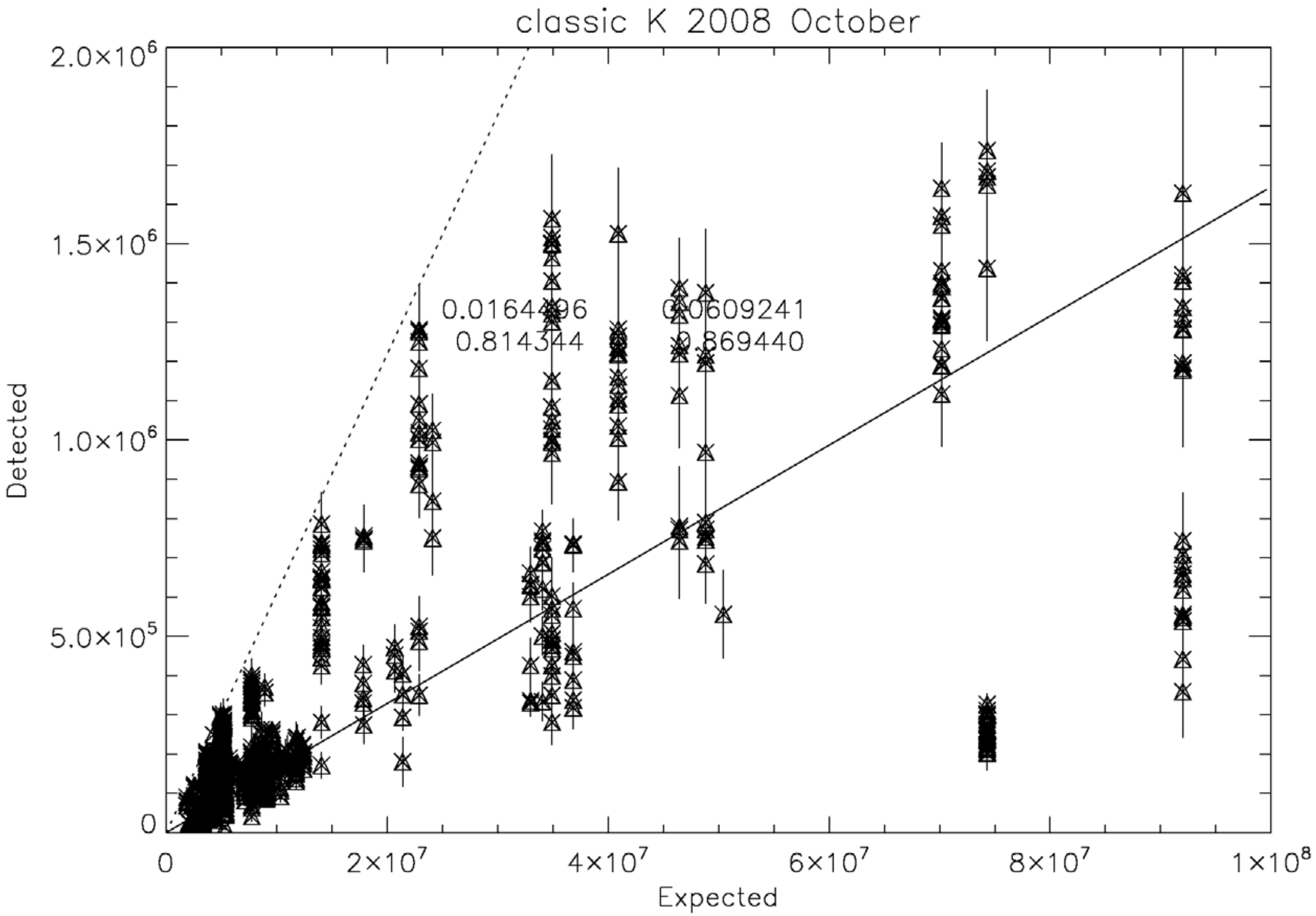
- Automated editing – Fringe > 1.1 Noise Power
- Took approximately 200 minutes to crunch.
- V < 0 and V > 1 thrown away.
- Not reliable for science.
- K&H magnitudes extracted from 2MASS.
- Stars without 2MASS data thrown away.
- Includes both calibrators and science targets.

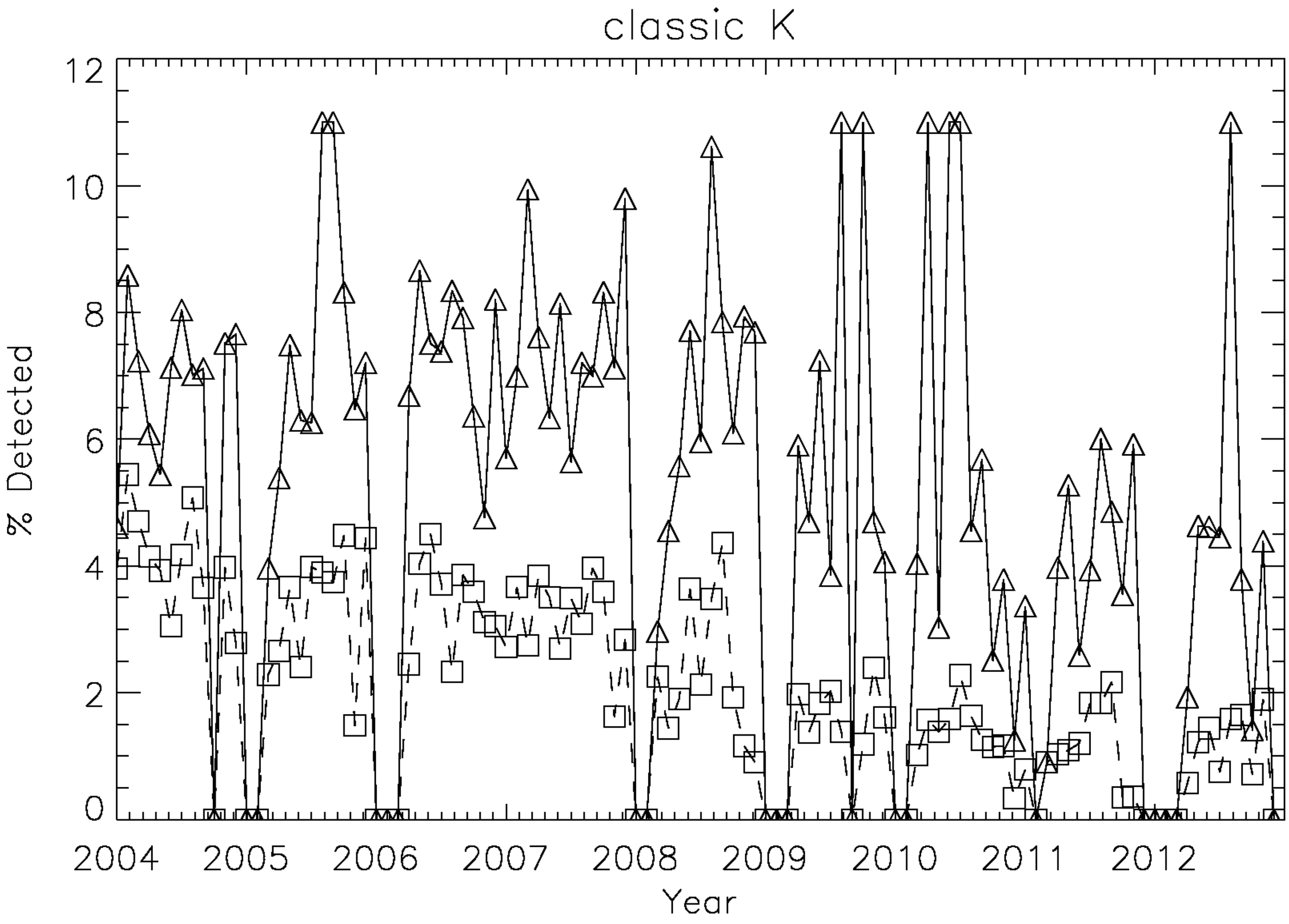
Amount of Data

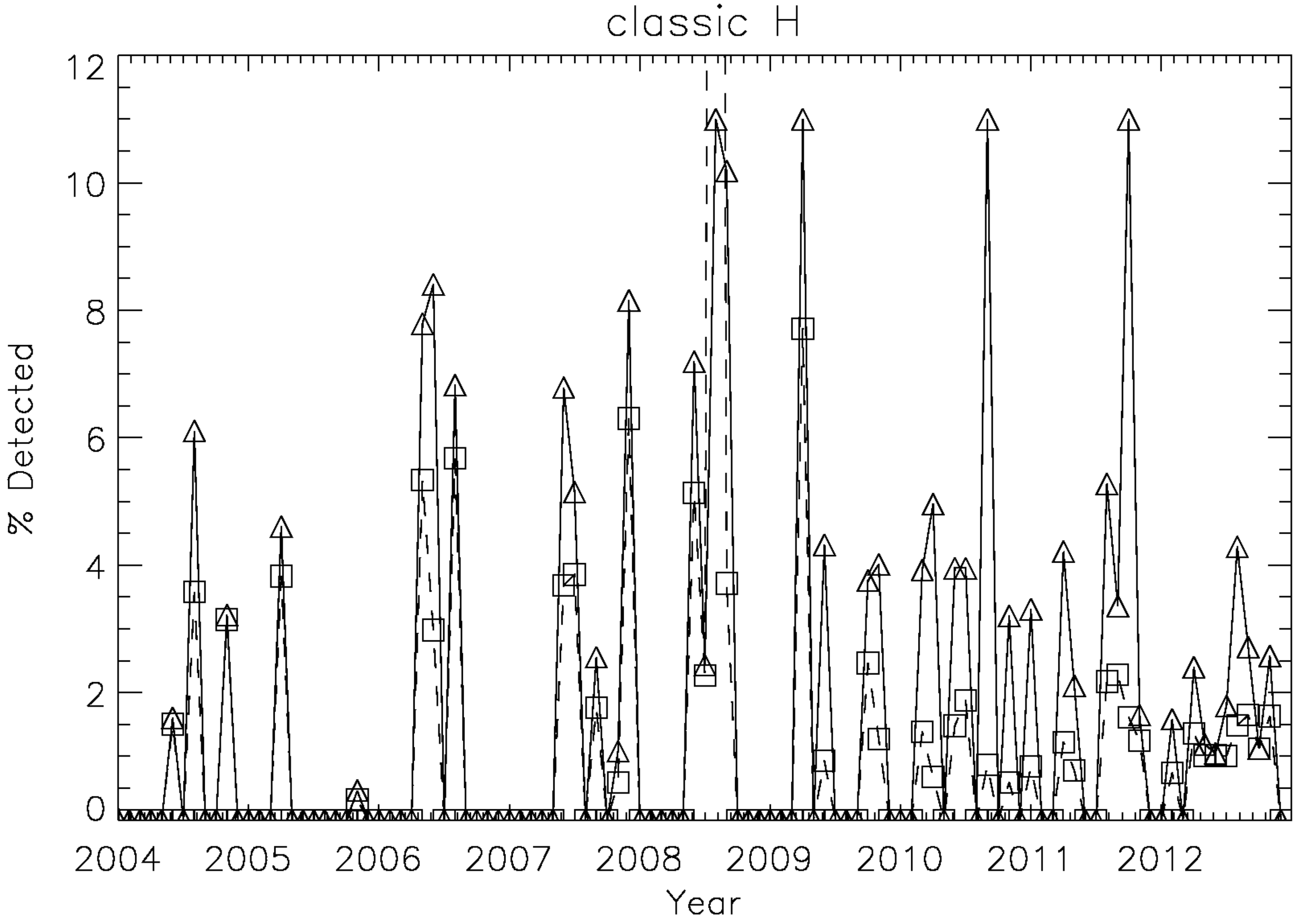


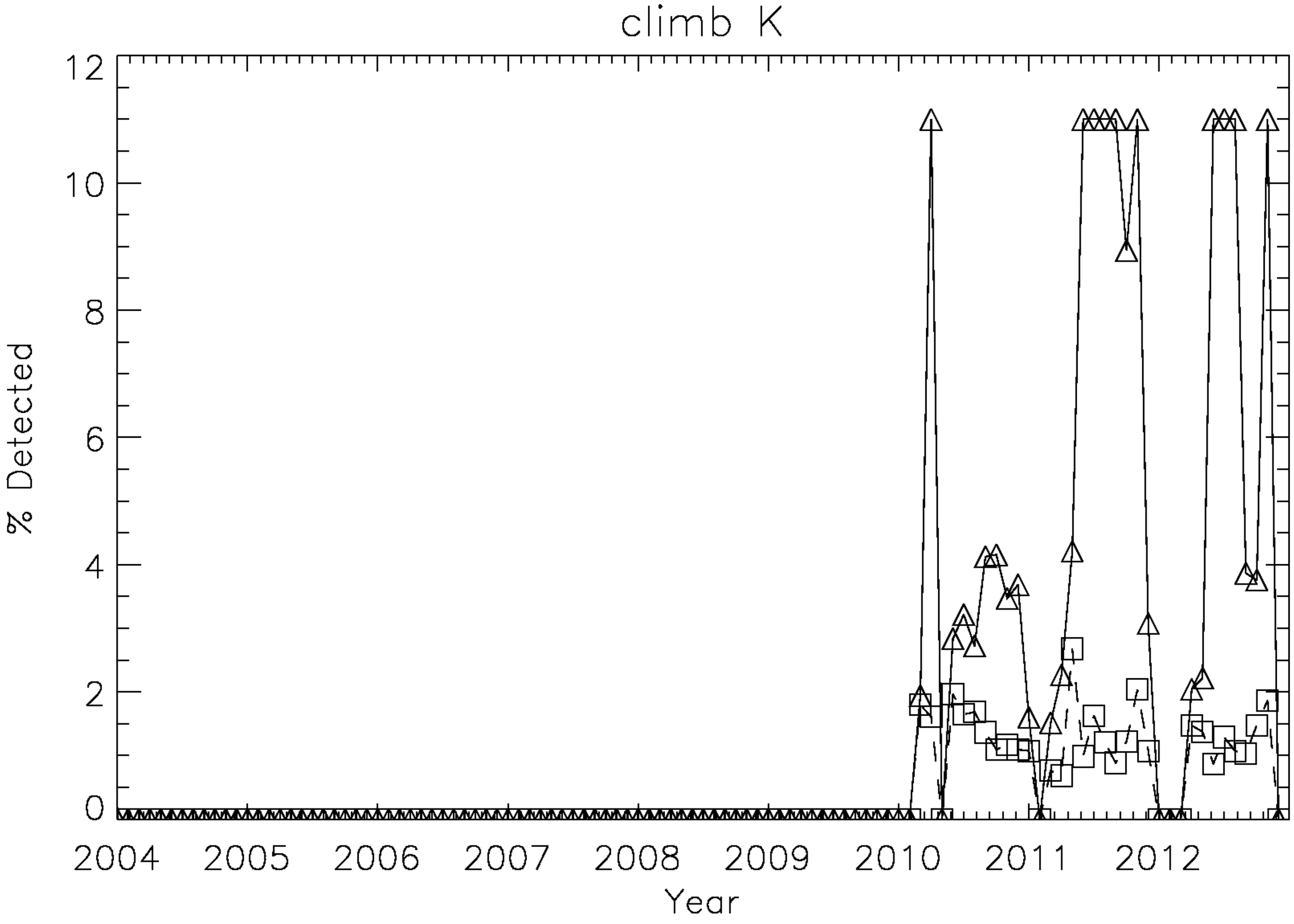
K/H Mags are converted to a photon count.

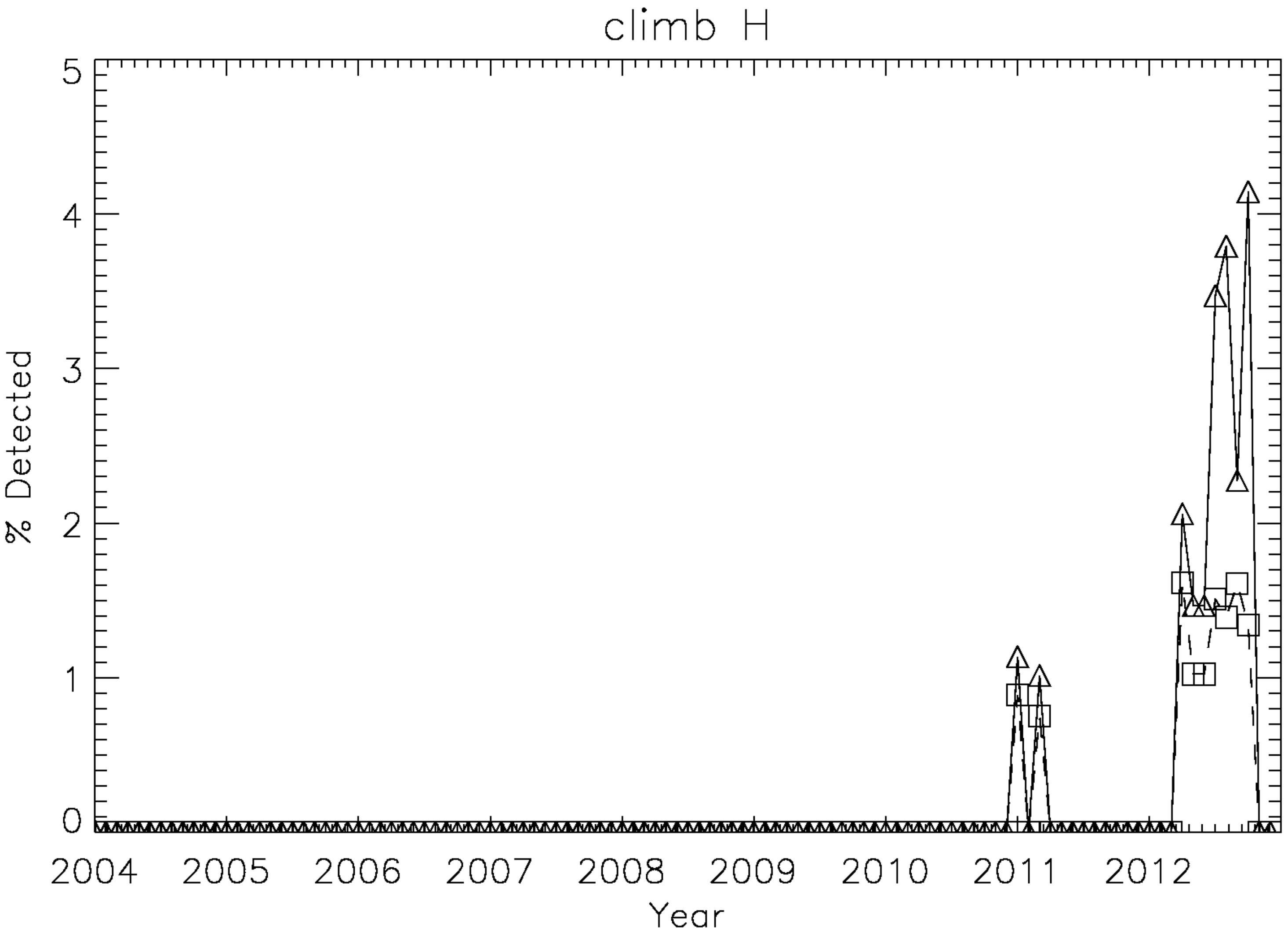
- Uses numbers from Camping, Rieke & Lebofsky PASP **90**, 896i (1995): For Mag 0 Star:
  - J Band 1.26 micron: 1603 Jy
  - H Band 1.60 micron: 1075 Jy
  - K Band 2.22 micron: 667 Jy
- 1 Jy = 1.51×10^{7} Photons S^{-1} m^{-2} $(d\lambda/\lambda)^{-1}$
- All data are calibrated to 1 second.
- This assumes the NIRO readout mode behaves.
- Camera Gain = 0.3, DQE = 60%.


classic K 2008 October
Detected
Expected
2.0×10⁶
1.5×10⁶
1.0×10⁶
5.0×10⁵
0
0
2×10⁷
4×10⁷
6×10⁷
8×10⁷
1×10⁸
0.0164496
0.814344
0.0609241
0.869440

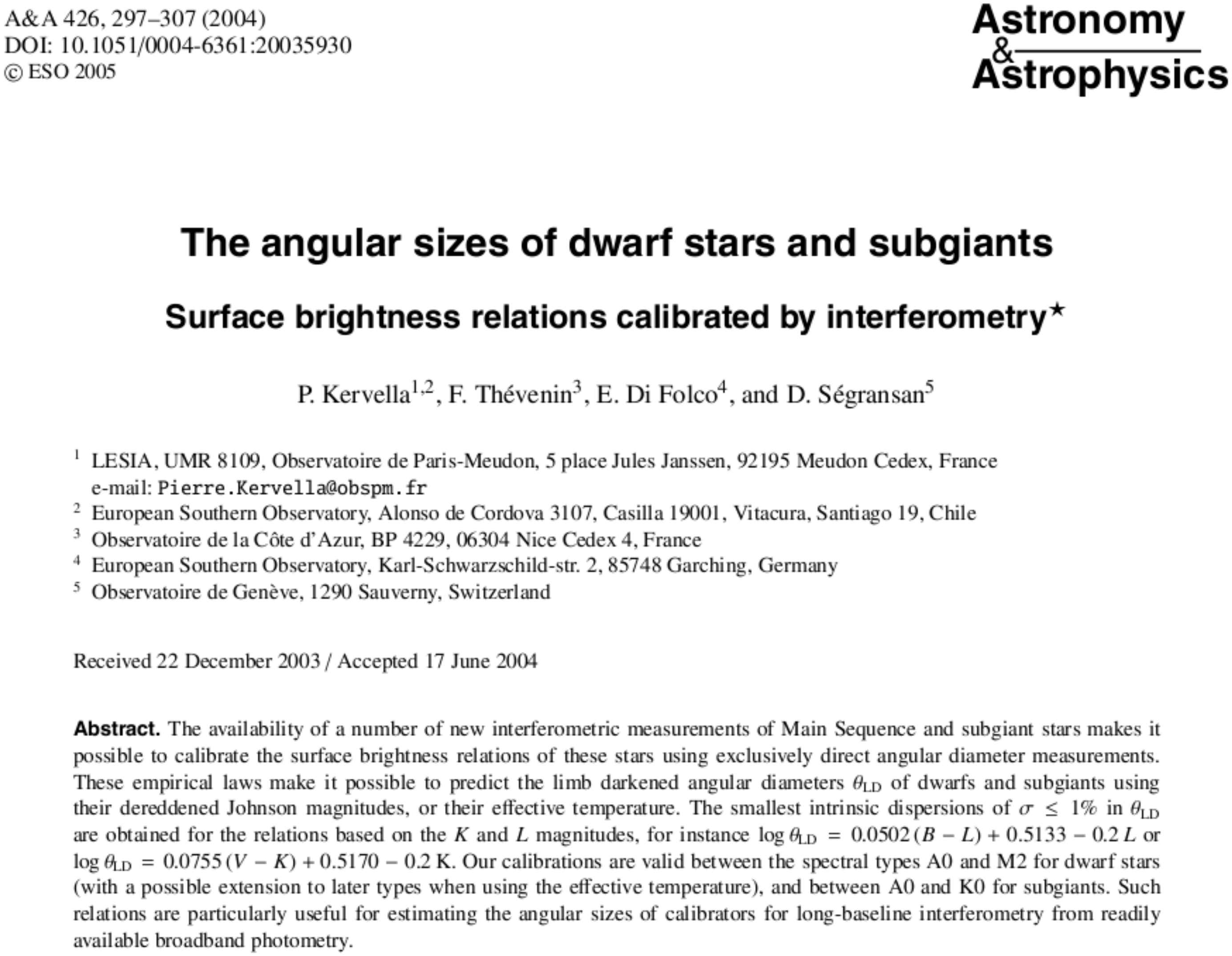

classic K
% Detected
Year
0
2
4
6
8
10
12
2004
2005
2006
2007
2008
2009
2010
2011
2012


classic H
% Detected
Year
0
2
4
6
8
10
12
2004
2005
2006
2007
2008
2009
2010
2011
2012


climb K
12
10
8
6
4
2
0
% Detected
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year


climb H
% Detected
0
1
2
3
4
5
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year

System Visibilities are Corrected For Estimated Stellar Diameter



A&A 426, 297–307 (2004)
DOI: 10.1051/0004-6361:20035930

Astronomy & Astrophysics

The angular sizes of dwarf stars and subgiants

Surface brightness relations calibrated by interferometry*

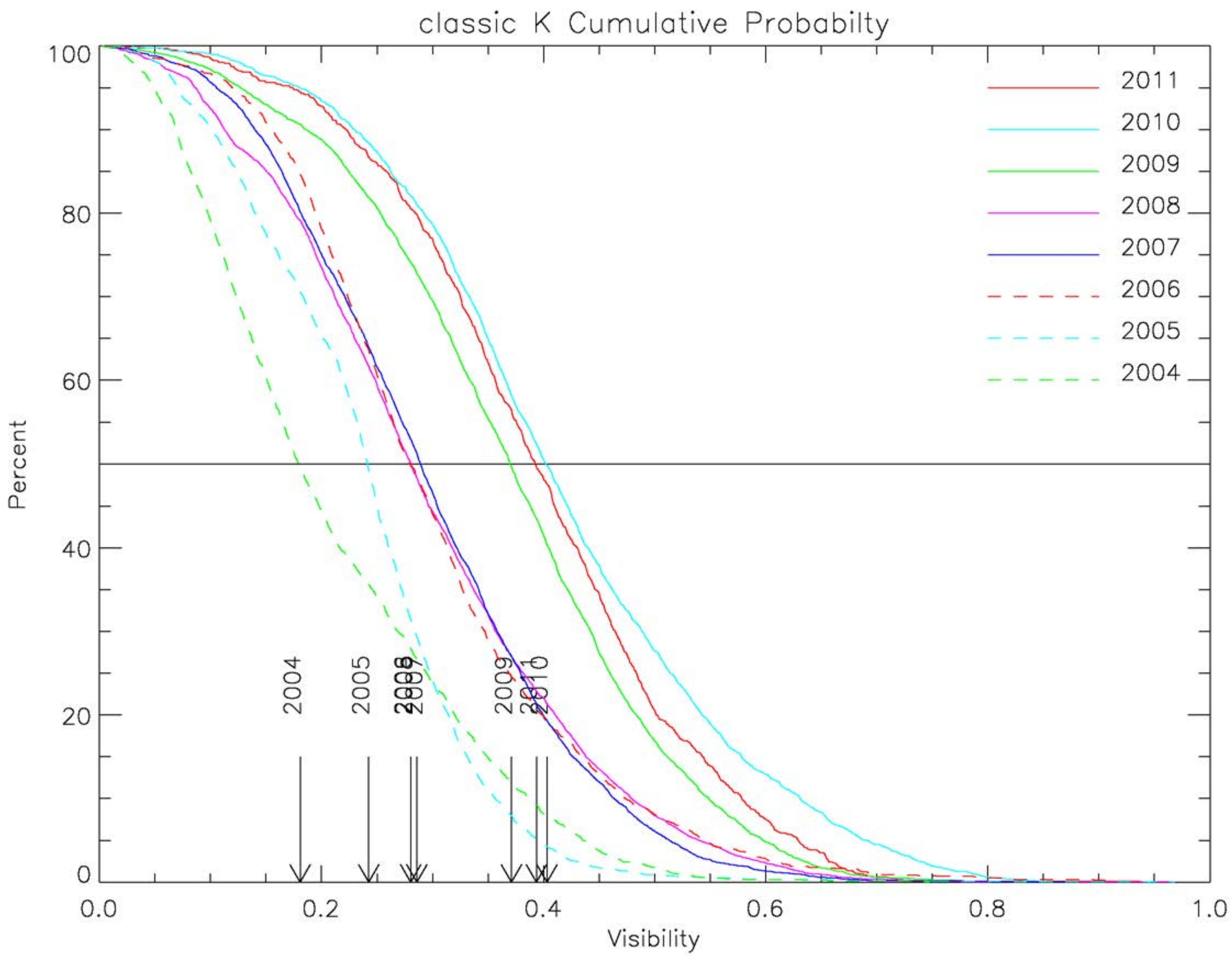
P. Kervella[1,2], F. Thévenin[3], E. Di Folco[4], and D. Ségransan[5]

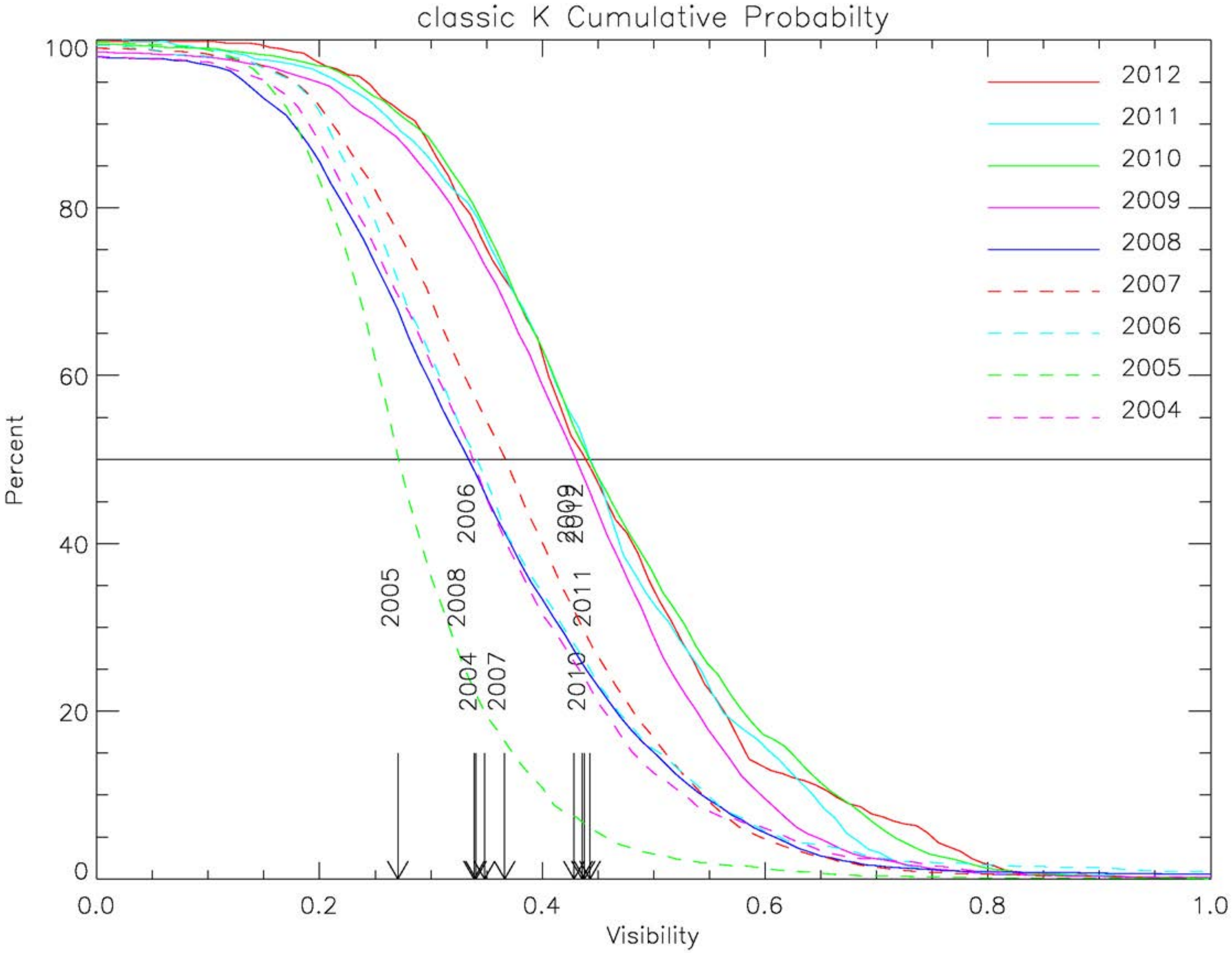
[1] LESIA, UMR 8109, Observatoire de Paris-Meudon, 5 place Jules Janssen, 92195 Meudon Cedex, France
e-mail: `Pierre.Kervella@obspm.fr`
[2] European Southern Observatory, Alonso de Cordova 3107, Casilla 19001, Vitacura, Santiago 19, Chile
[3] Observatoire de la Côte d'Azur, BP 4229, 06304 Nice Cedex 4, France
[4] European Southern Observatory, Karl-Schwarzschild-str. 2, 85748 Garching, Germany
[5] Observatoire de Genève, 1290 Sauverny, Switzerland

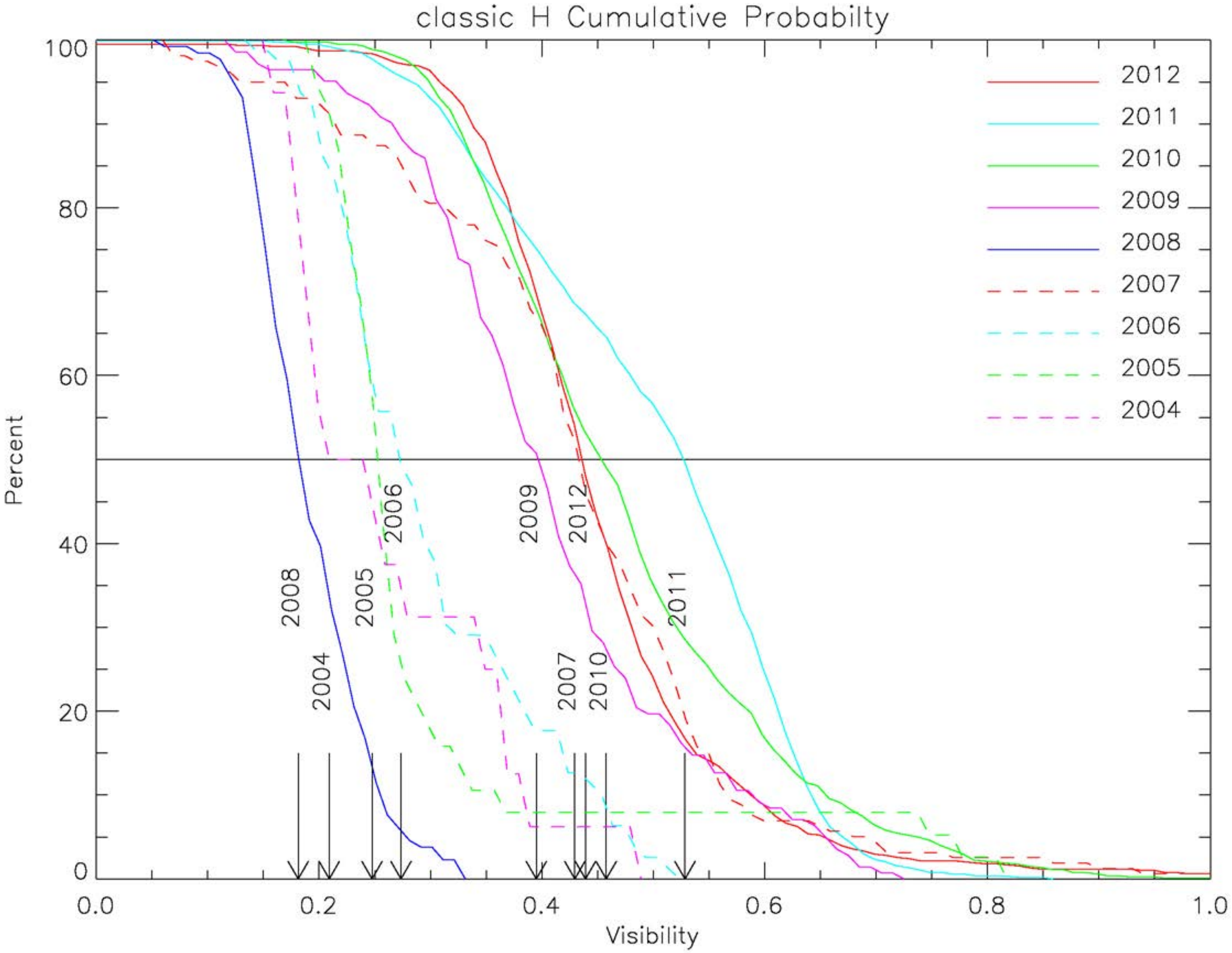
Received 22 December 2003 / Accepted 17 June 2004

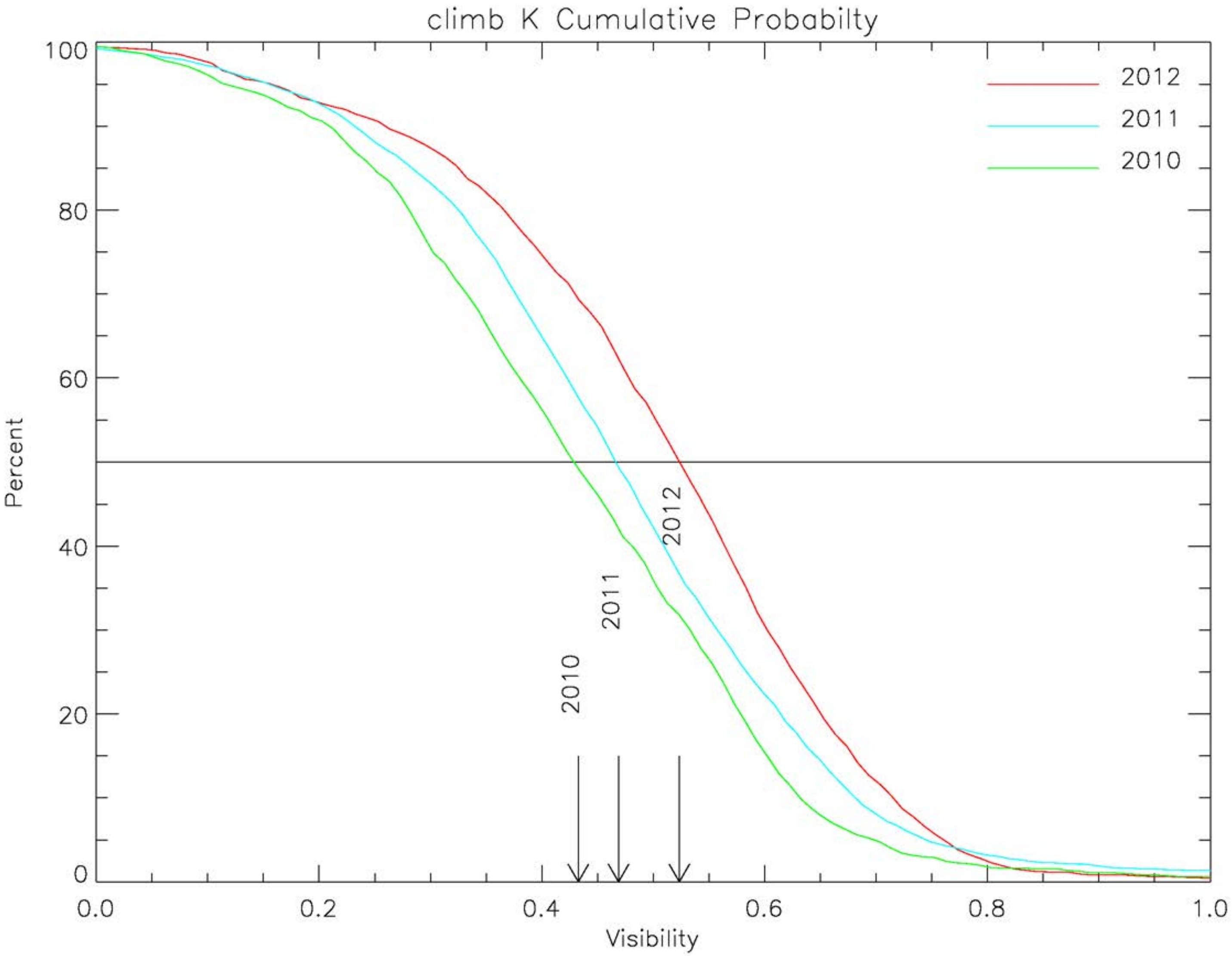
Abstract. The availability of a number of new interferometric measurements of Main Sequence and subgiant stars makes it possible to calibrate the surface brightness relations of these stars using exclusively direct angular diameter measurements. These empirical laws make it possible to predict the limb darkened angular diameters $\theta_{\rm LD}$ of dwarfs and subgiants using their dereddened Johnson magnitudes, or their effective temperature. The smallest intrinsic dispersions of $\sigma \leq 1\%$ in $\theta_{\rm LD}$ are obtained for the relations based on the K and L magnitudes, for instance $\log \theta_{\rm LD} = 0.0502\,(B-L) + 0.5133 - 0.2\,L$ or $\log \theta_{\rm LD} = 0.0755\,(V-K) + 0.5170 - 0.2\,{\rm K}$. Our calibrations are valid between the spectral types A0 and M2 for dwarf stars (with a possible extension to later types when using the effective temperature), and between A0 and K0 for subgiants. Such relations are particularly useful for estimating the angular sizes of calibrators for long-baseline interferometry from readily available broadband photometry.

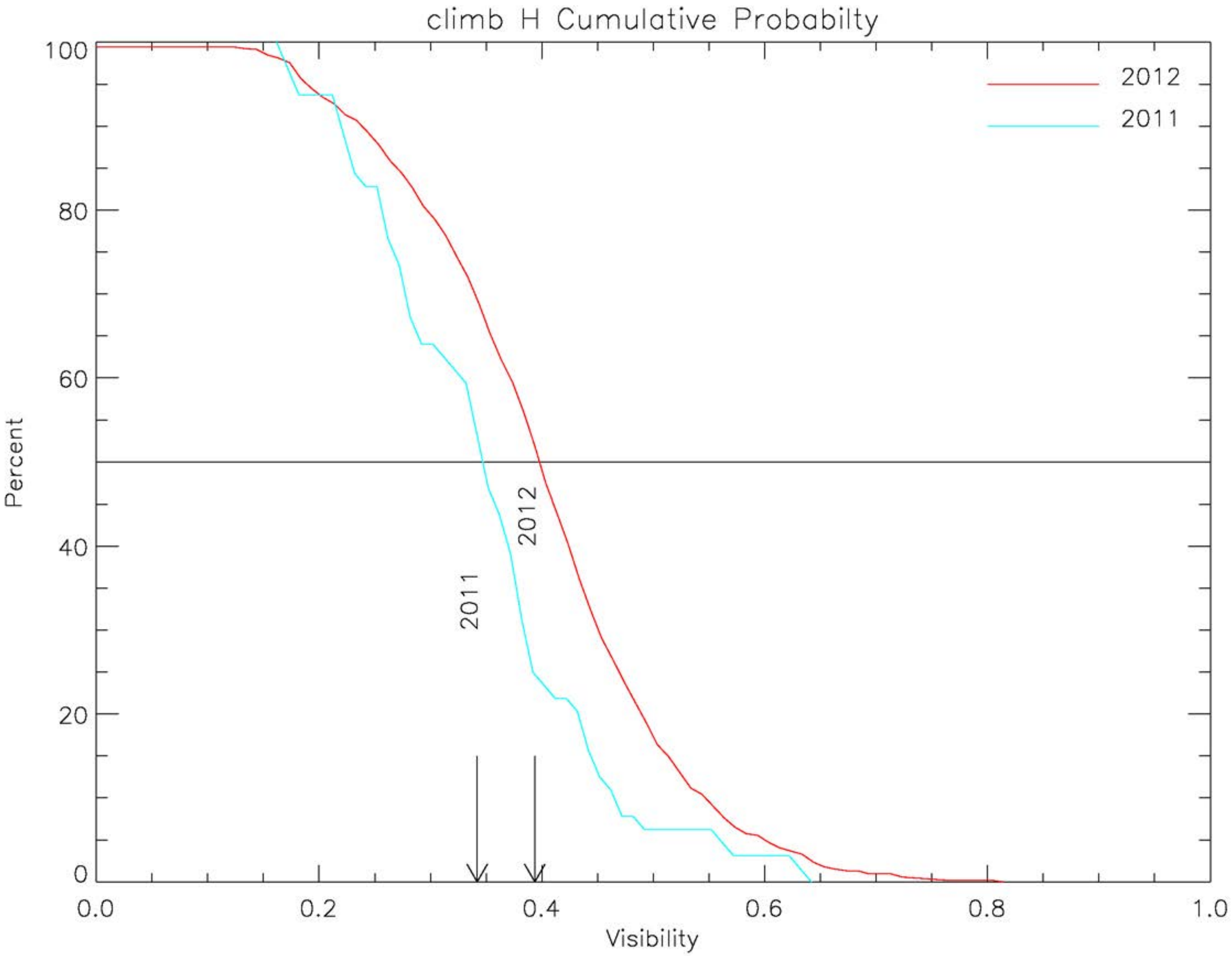
Uncorrected result from last year:



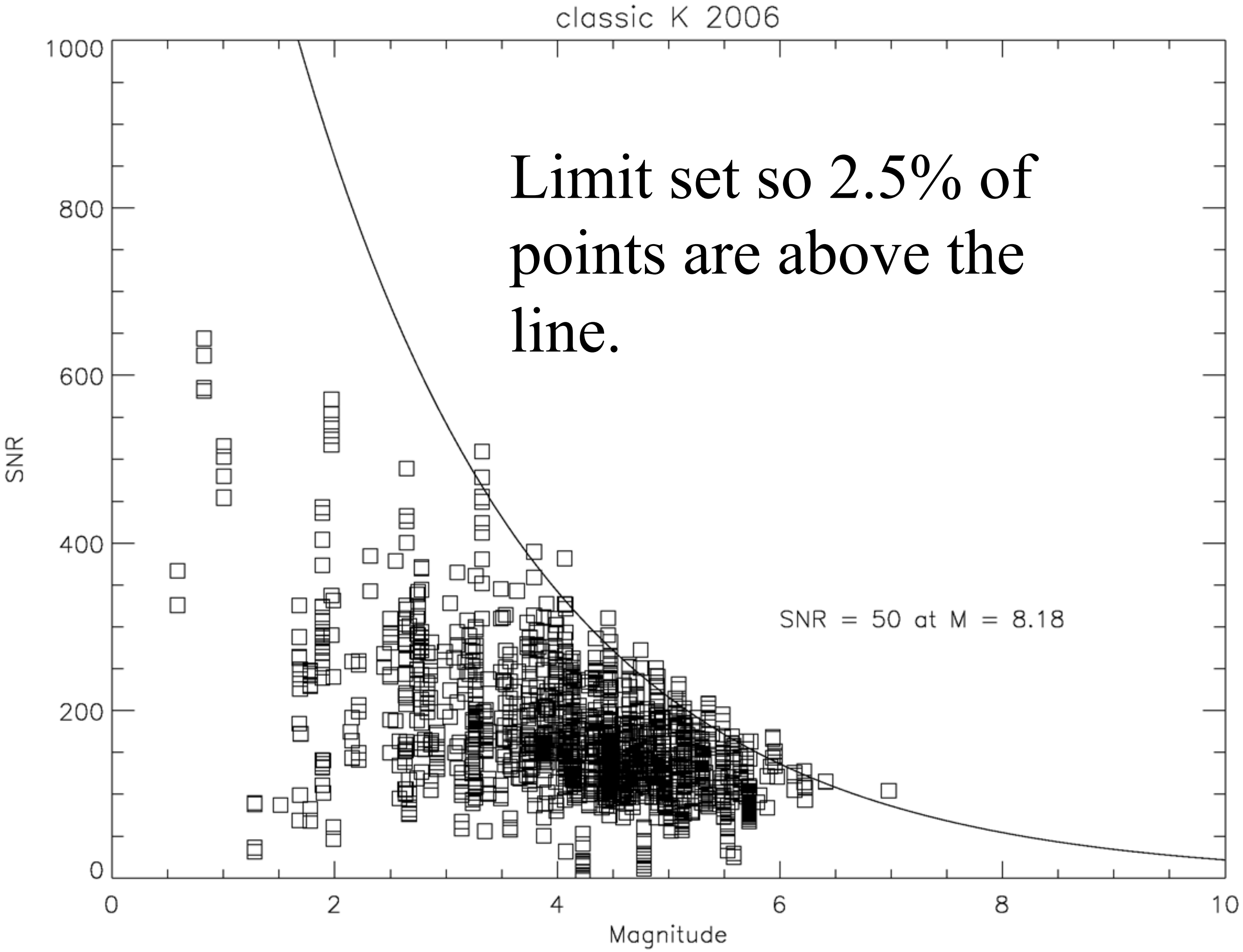

classic K Cumulative Probabilty
Percent
Visibility
0
20
40
60
80
100
0.0
0.2
0.4
0.6
0.8
1.0
2012
2011
2010
2009
2008
2007
2006
2005
2004
2005
2008
2006
2004
2007
2010
2011
2009
2012


classic H Cumulative Probabilty
Percent
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
1.0
Visibility
2012
2011
2010
2009
2008
2007
2006
2005
2004
2008
2004
2005
2006
2009
2012
2007
2010
2011

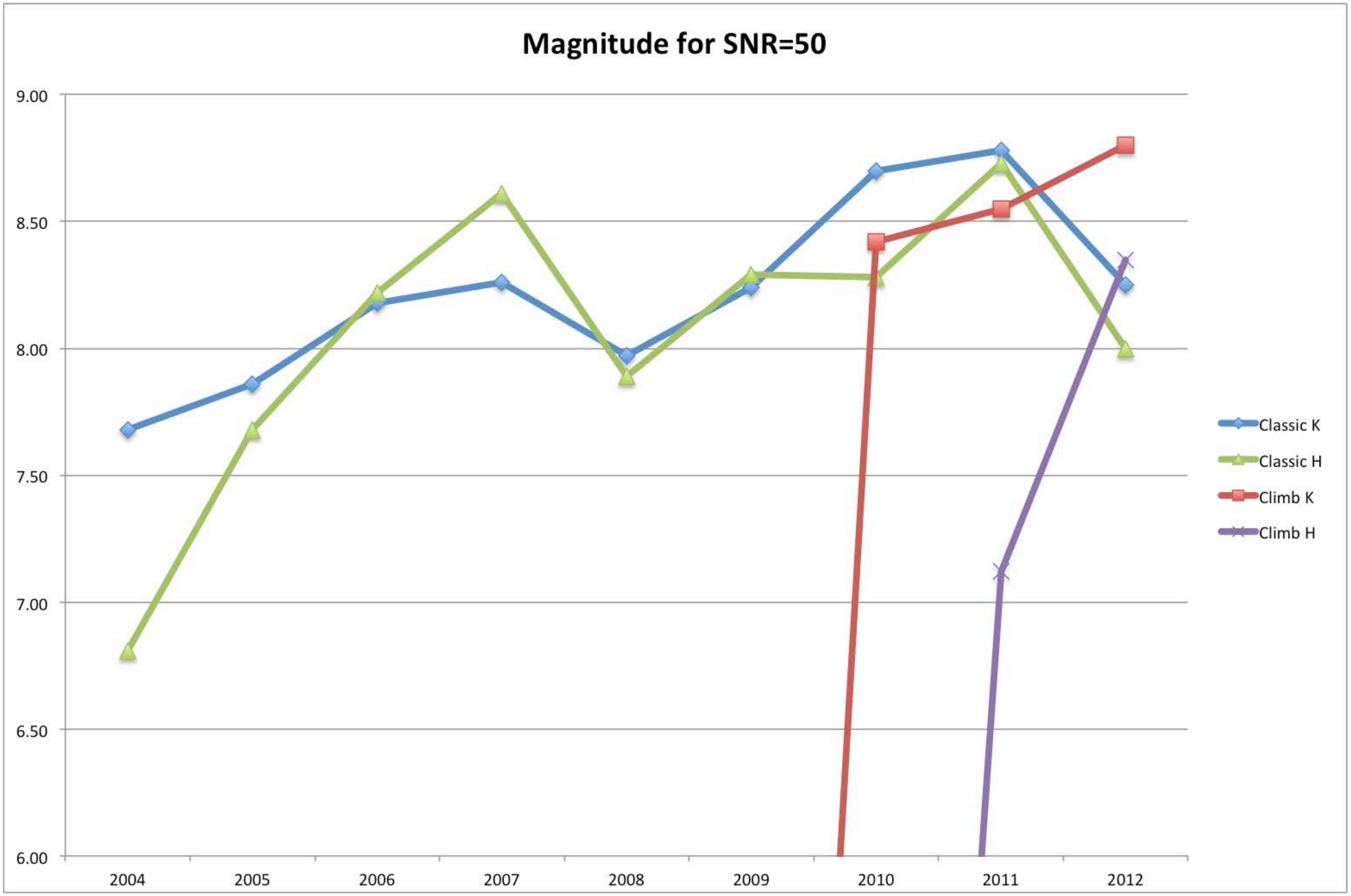

climb K Cumulative Probabilty
Percent
Visibility
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
1.0
2012
2011
2010
2010
2011
2012


climb H Cumulative Probabilty
Percent
Visibility
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
1.0
2012
2011
2012
2011

SNR ~ V_{raw} * sqrt(N)

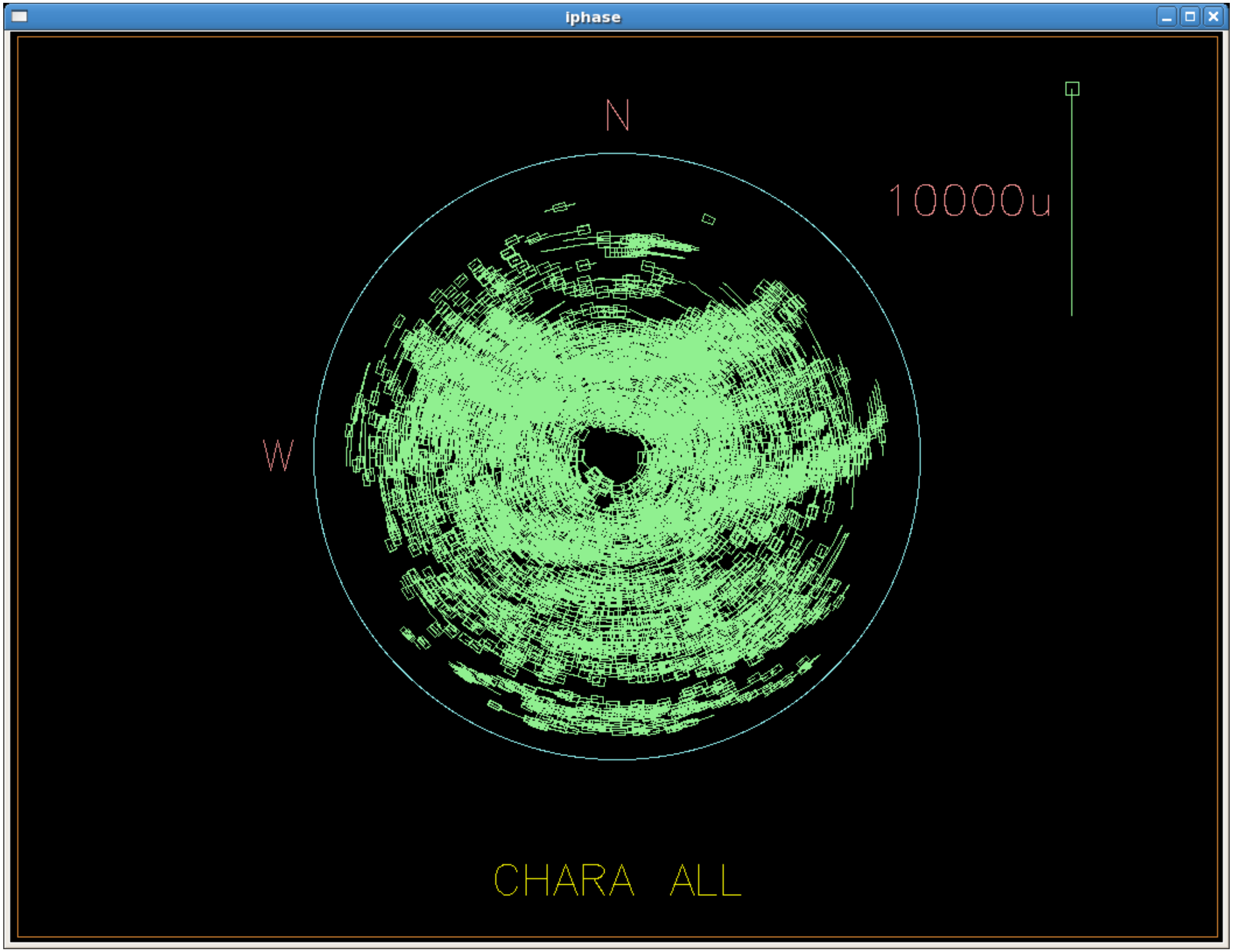


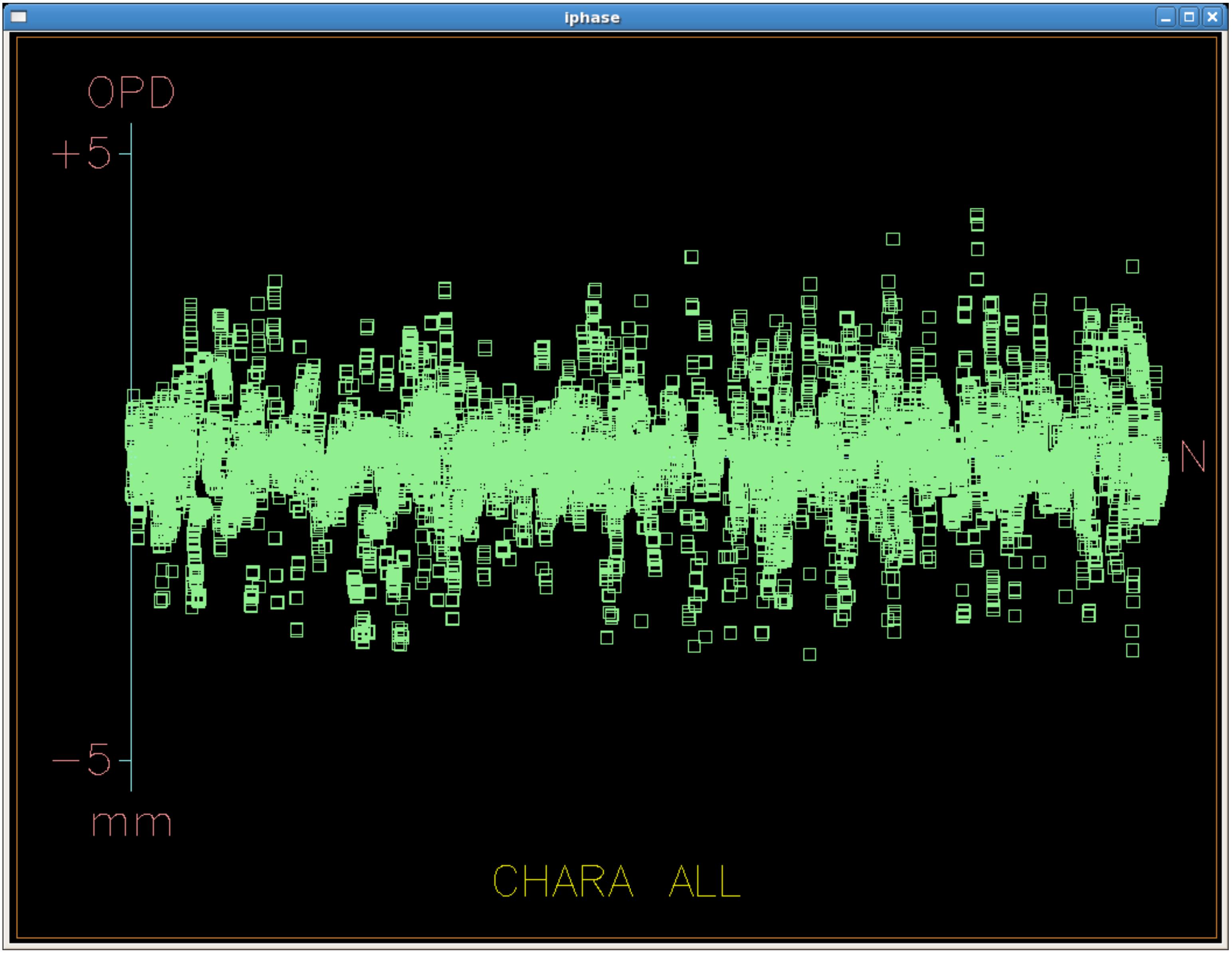
Limit set so 2.5% of points are above the line.

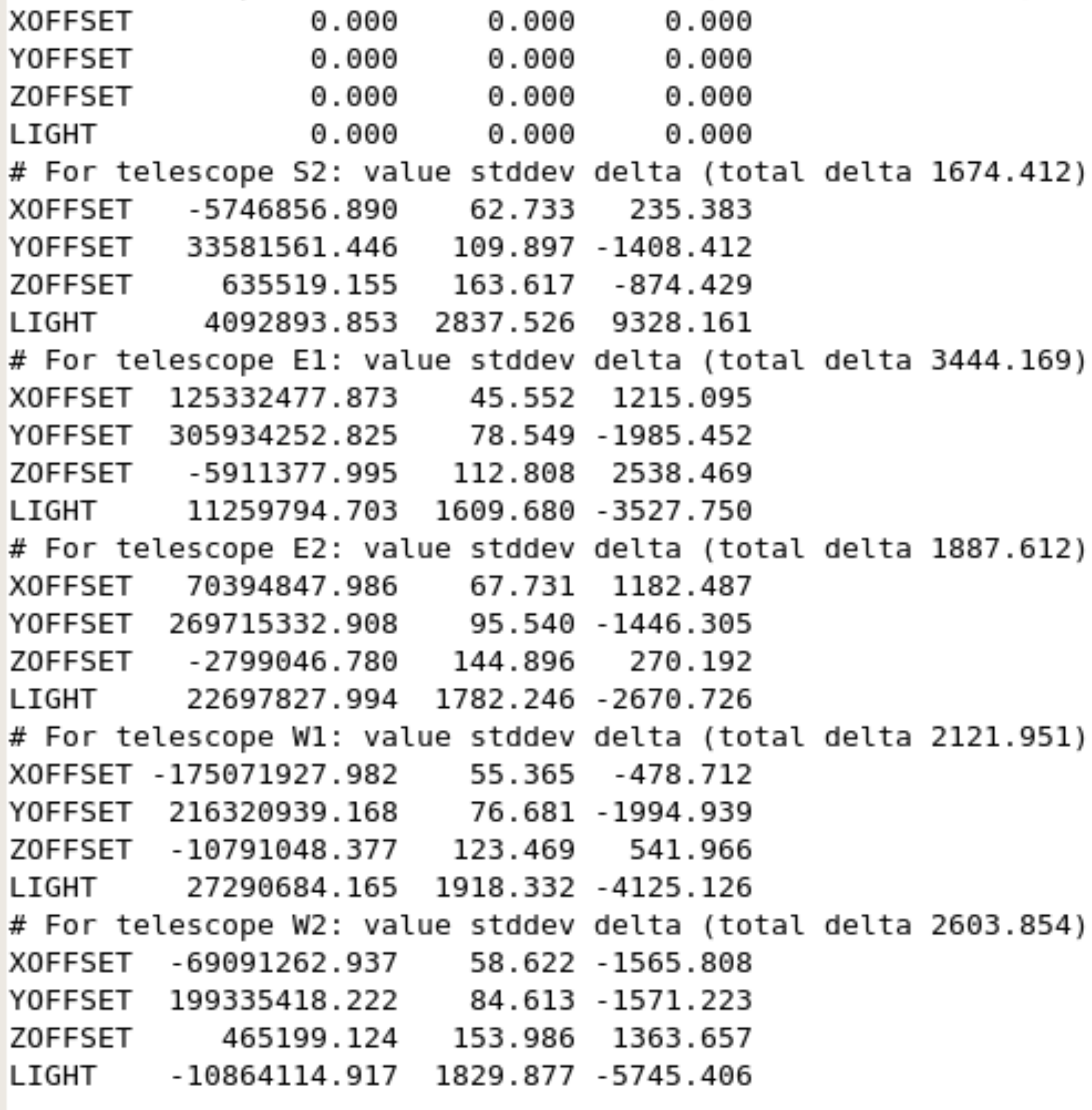

Magnitude for SNR=50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
2004
2005
2006
2007
2008
2009
2010
2011
2012
Classic K
Classic H
Climb K
Climb H

New Baseline Solution

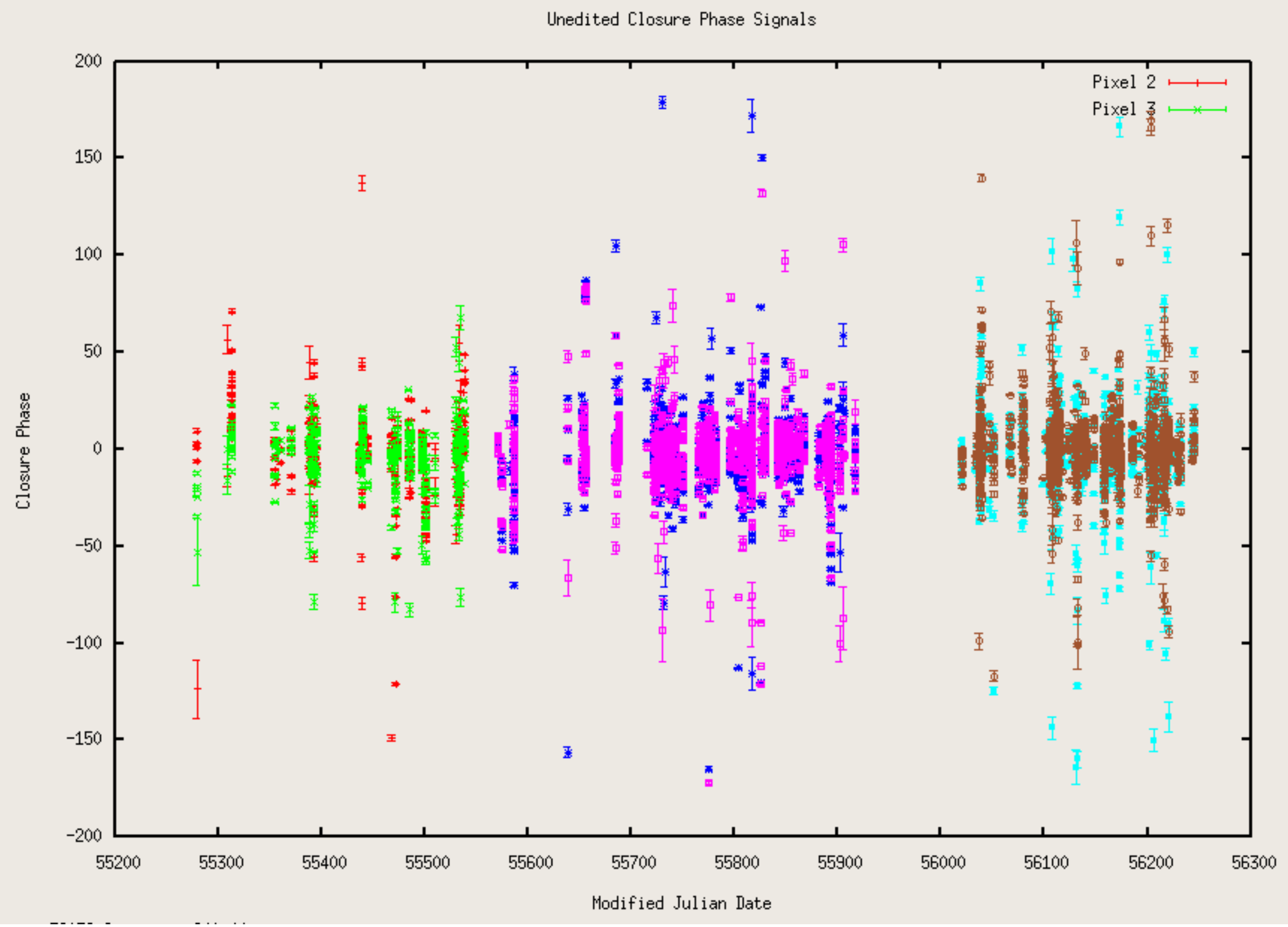
- The system records the OPLE demand positions and current scope Alt/Az when fringes are found.
- This is now automated for all beam combiners.
- 134889 baseline solution data points were recorded.
- The demand position is better for modeling than the measured position.
- The height of a scope is degenerate 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.


iphase
N
W
10000u
CHARA ALL


iphase
OPD
+5
−5
mm
N
CHARA ALL

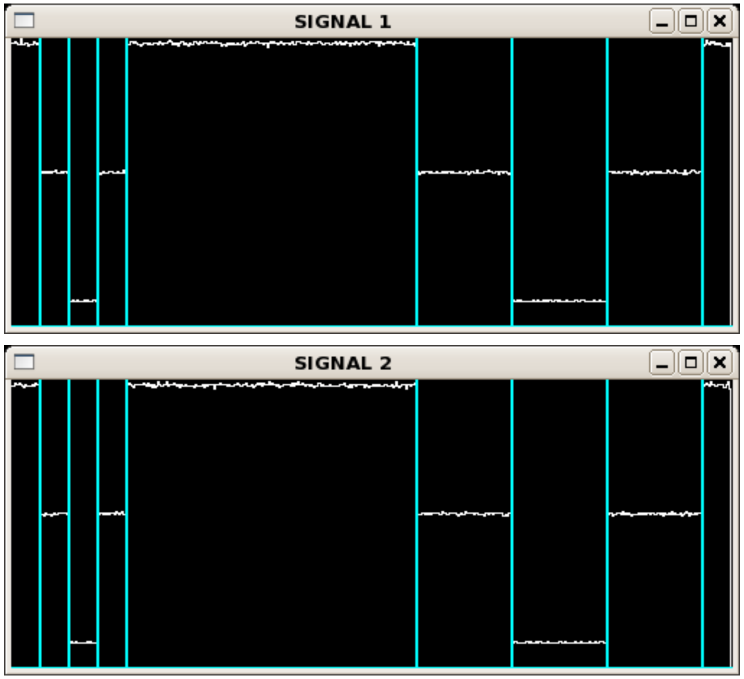


```
# For telescope S1: value stddev delta (total delta 0.000)
XOFFSET          0.000      0.000      0.000
YOFFSET          0.000      0.000      0.000
ZOFFSET          0.000      0.000      0.000
LIGHT            0.000      0.000      0.000
# For telescope S2: value stddev delta (total delta 1674.412)
XOFFSET   -5746856.890     62.733    235.383
YOFFSET   33581561.446    109.897  -1408.412
ZOFFSET     635519.155    163.617   -874.429
LIGHT      4092893.853   2837.526   9328.161
# For telescope E1: value stddev delta (total delta 3444.169)
XOFFSET  125332477.873     45.552   1215.095
YOFFSET  305934252.825     78.549  -1985.452
ZOFFSET   -5911377.995    112.808   2538.469
LIGHT     11259794.703   1609.680  -3527.750
# For telescope E2: value stddev delta (total delta 1887.612)
XOFFSET   70394847.986     67.731   1182.487
YOFFSET  269715332.908     95.540  -1446.305
ZOFFSET   -2799046.780    144.896    270.192
LIGHT     22697827.994   1782.246  -2670.726
# For telescope W1: value stddev delta (total delta 2121.951)
XOFFSET -175071927.982     55.365   -478.712
YOFFSET  216320939.168     76.681  -1994.939
ZOFFSET  -10791048.377    123.469    541.966
LIGHT     27290684.165   1918.332  -4125.126
# For telescope W2: value stddev delta (total delta 2603.854)
XOFFSET  -69091262.937     58.622  -1565.808
YOFFSET  199335418.222     84.613  -1571.223
ZOFFSET     465199.124    153.986   1363.657
LIGHT    -10864114.917   1829.877  -5745.406
```

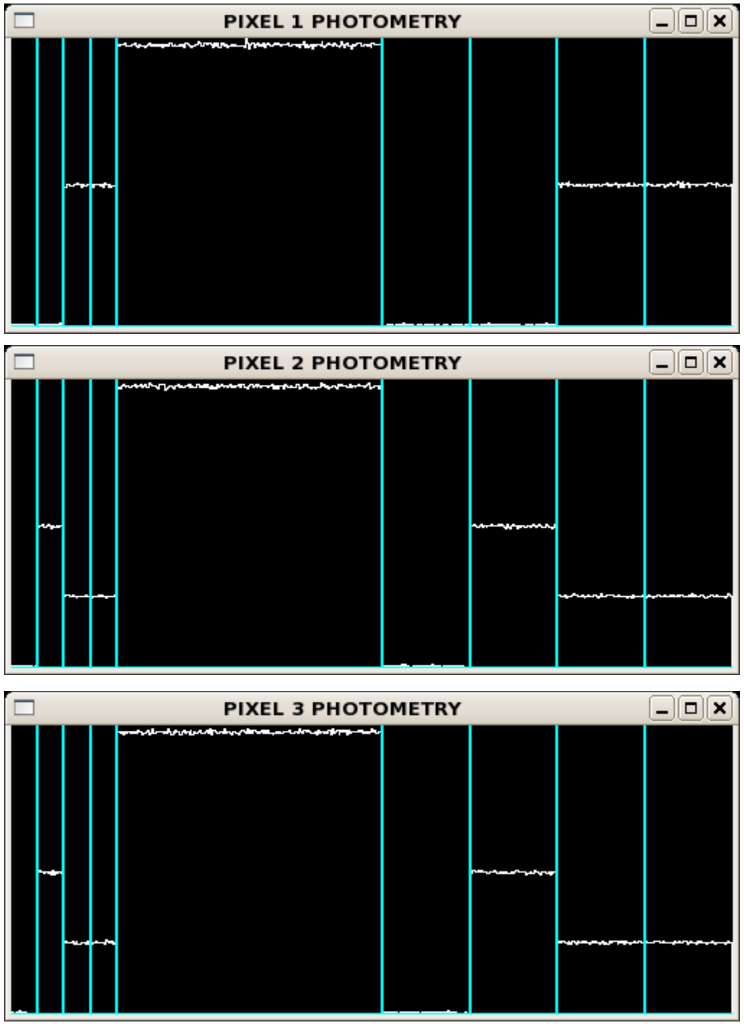

Unedited Closure Phase Signals
Pixel 2
Pixel 3
Closure Phase
200
150
100
50
0
-50
-100
-150
-200
55200
55300
55400
55500
55600
55700
55800
55900
56000
56100
56200
56300
Modified Julian Date

Old Shutter Sequence

Classic

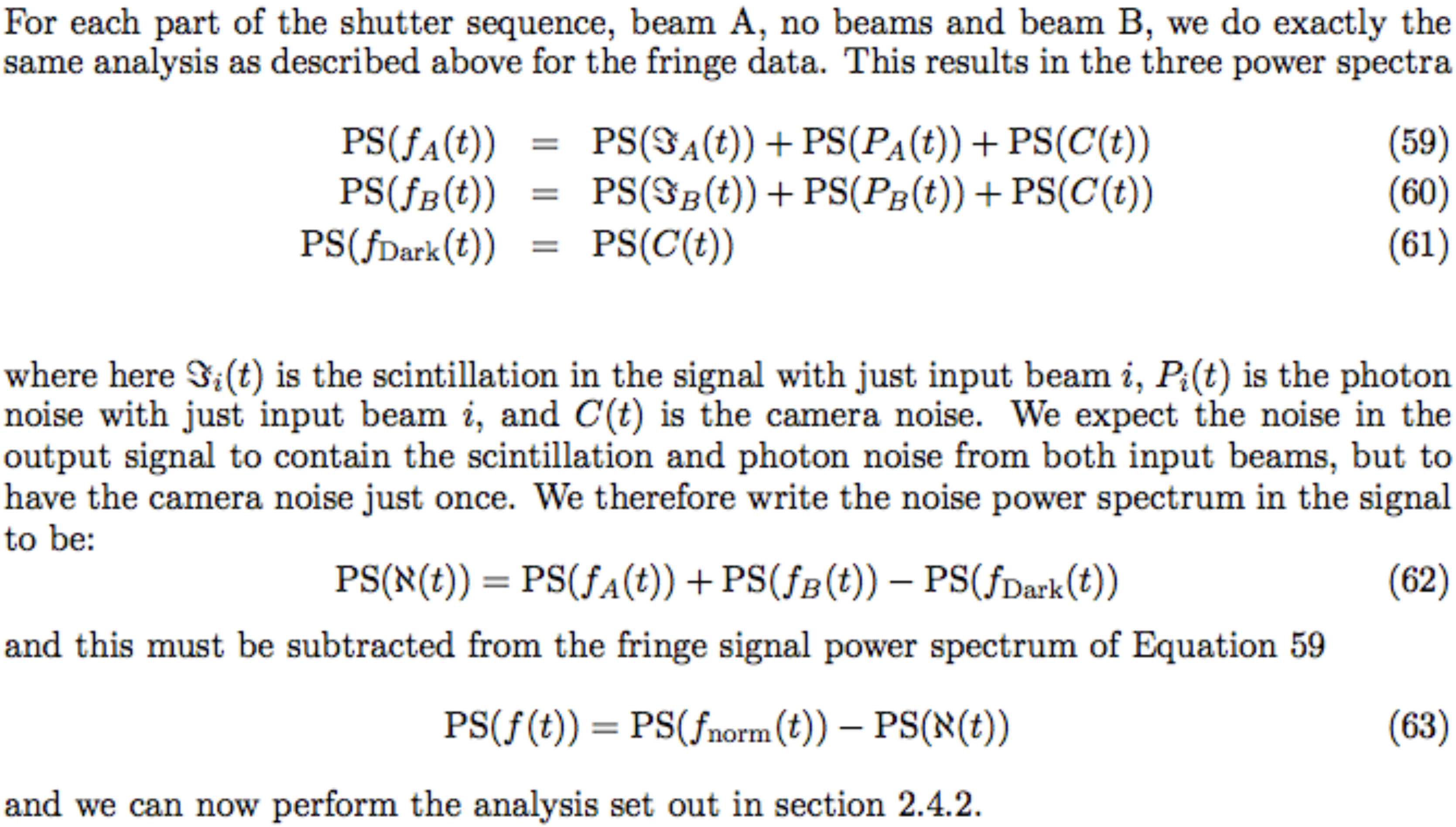


Climb



This made the Math difficult:

Classic



For each part of the shutter sequence, beam A, no beams and beam B, we do exactly the same analysis as described above for the fringe data. This results in the three power spectra

$$\begin{aligned} \mathrm{PS}(f_A(t)) &= \mathrm{PS}(\Im_A(t)) + \mathrm{PS}(P_A(t)) + \mathrm{PS}(C(t)) && (59) \\ \mathrm{PS}(f_B(t)) &= \mathrm{PS}(\Im_B(t)) + \mathrm{PS}(P_B(t)) + \mathrm{PS}(C(t)) && (60) \\ \mathrm{PS}(f_{\mathrm{Dark}}(t)) &= \mathrm{PS}(C(t)) && (61) \end{aligned}$$

where here $\Im_i(t)$ is the scintillation in the signal with just input beam i, $P_i(t)$ is the photon noise with just input beam i, and $C(t)$ is the camera noise. We expect the noise in the output signal to contain the scintillation and photon noise from both input beams, but to have the camera noise just once. We therefore write the noise power spectrum in the signal to be:

$$\mathrm{PS}(\aleph(t)) = \mathrm{PS}(f_A(t)) + \mathrm{PS}(f_B(t)) - \mathrm{PS}(f_{\mathrm{Dark}}(t)) \qquad (62)$$

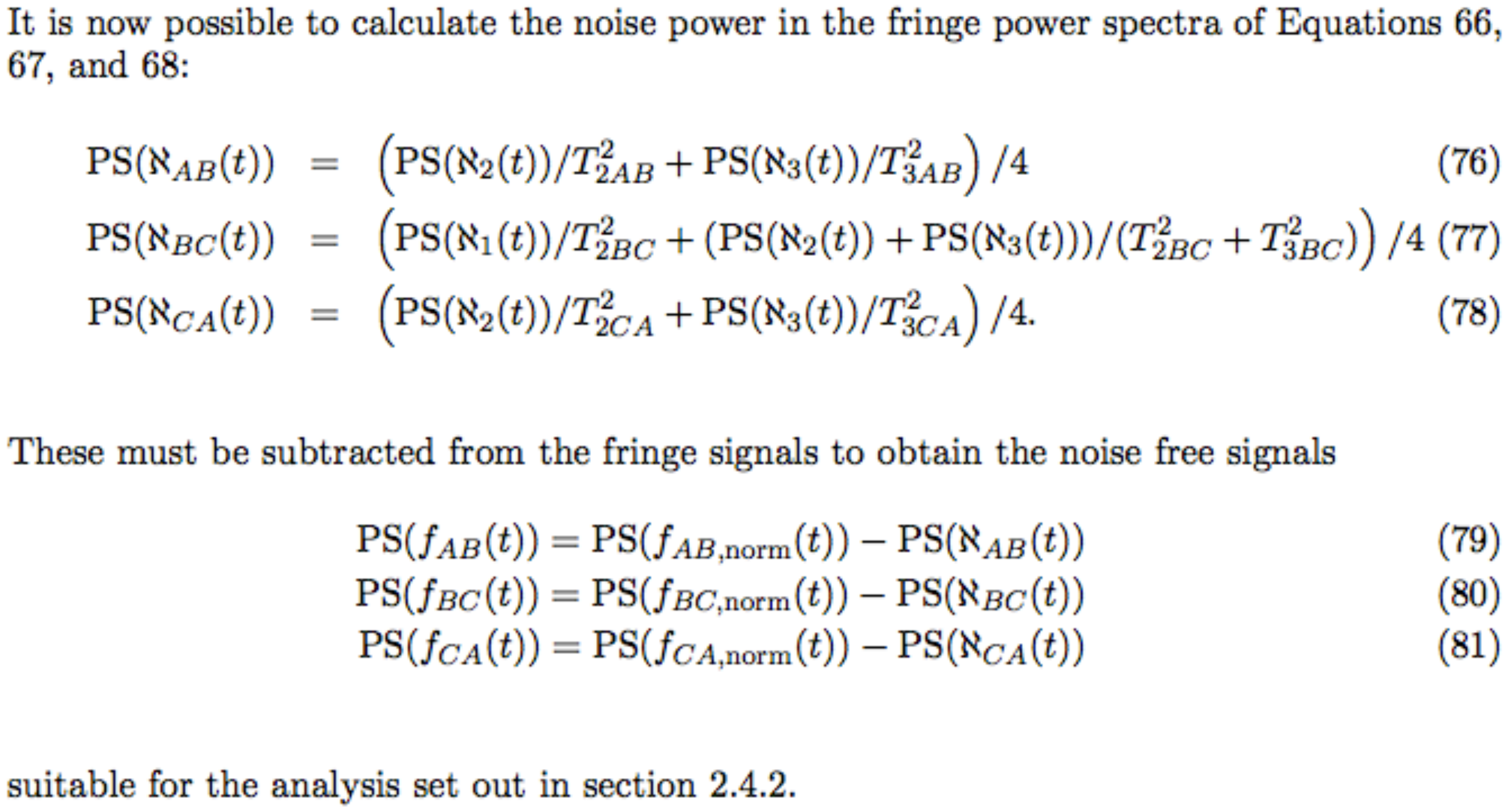
and this must be subtracted from the fringe signal power spectrum of Equation 59

$$\mathrm{PS}(f(t)) = \mathrm{PS}(f_{\mathrm{norm}}(t)) - \mathrm{PS}(\aleph(t)) \qquad (63)$$

and we can now perform the analysis set out in section 2.4.2.

This made the Math difficult:

Climb



It is now possible to calculate the noise power in the fringe power spectra of Equations 66, 67, and 68:

$$\mathrm{PS}(\aleph_{AB}(t)) = \left(\mathrm{PS}(\aleph_2(t))/T^2_{2AB} + \mathrm{PS}(\aleph_3(t))/T^2_{3AB}\right)/4 \quad (76)$$

$$\mathrm{PS}(\aleph_{BC}(t)) = \left(\mathrm{PS}(\aleph_1(t))/T^2_{2BC} + (\mathrm{PS}(\aleph_2(t)) + \mathrm{PS}(\aleph_3(t)))/(T^2_{2BC} + T^2_{3BC})\right)/4 \quad (77)$$

$$\mathrm{PS}(\aleph_{CA}(t)) = \left(\mathrm{PS}(\aleph_2(t))/T^2_{2CA} + \mathrm{PS}(\aleph_3(t))/T^2_{3CA}\right)/4. \quad (78)$$

These must be subtracted from the fringe signals to obtain the noise free signals

$$\mathrm{PS}(f_{AB}(t)) = \mathrm{PS}(f_{AB,\mathrm{norm}}(t)) - \mathrm{PS}(\aleph_{AB}(t)) \quad (79)$$

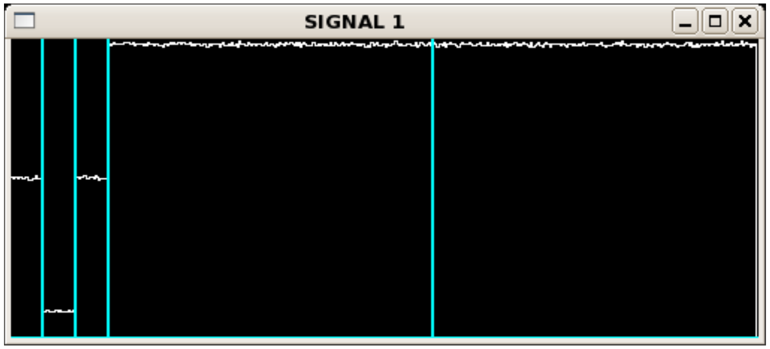
$$\mathrm{PS}(f_{BC}(t)) = \mathrm{PS}(f_{BC,\mathrm{norm}}(t)) - \mathrm{PS}(\aleph_{BC}(t)) \quad (80)$$

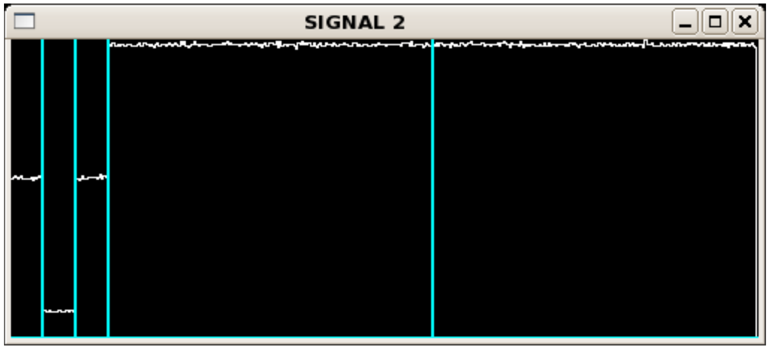
$$\mathrm{PS}(f_{CA}(t)) = \mathrm{PS}(f_{CA,\mathrm{norm}}(t)) - \mathrm{PS}(\aleph_{CA}(t)) \quad (81)$$

suitable for the analysis set out in section 2.4.2.

New Shutter Sequence

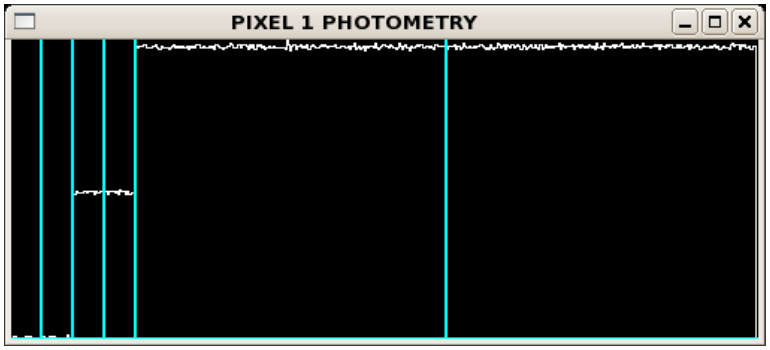
Classic

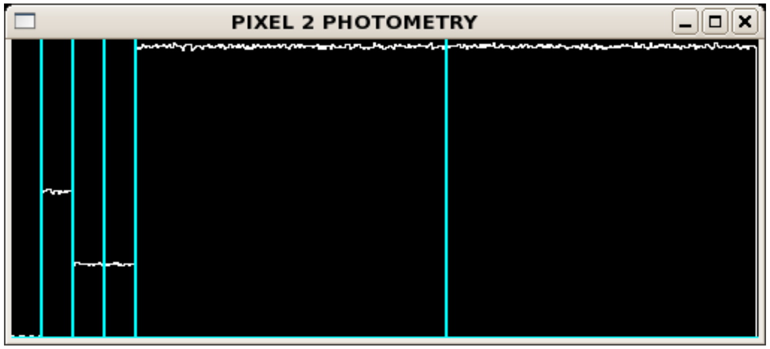


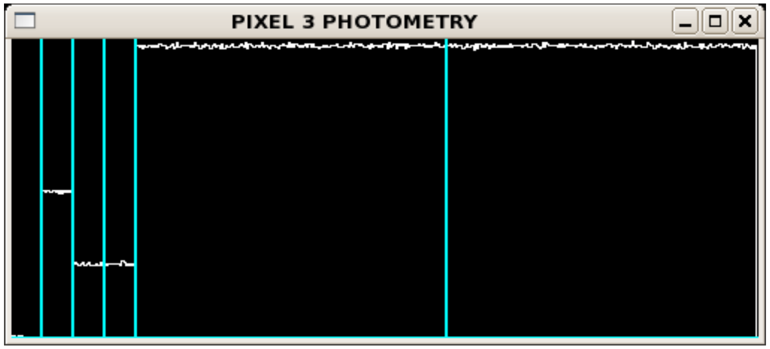


This gives a direct measurement of the background power.

Climb







CHARA Rocks!


Robby Krieger
(The Doors)
Arthur Barrow
And
Tommy Mars
(The Zappa Band)