Rate of Correct Detection

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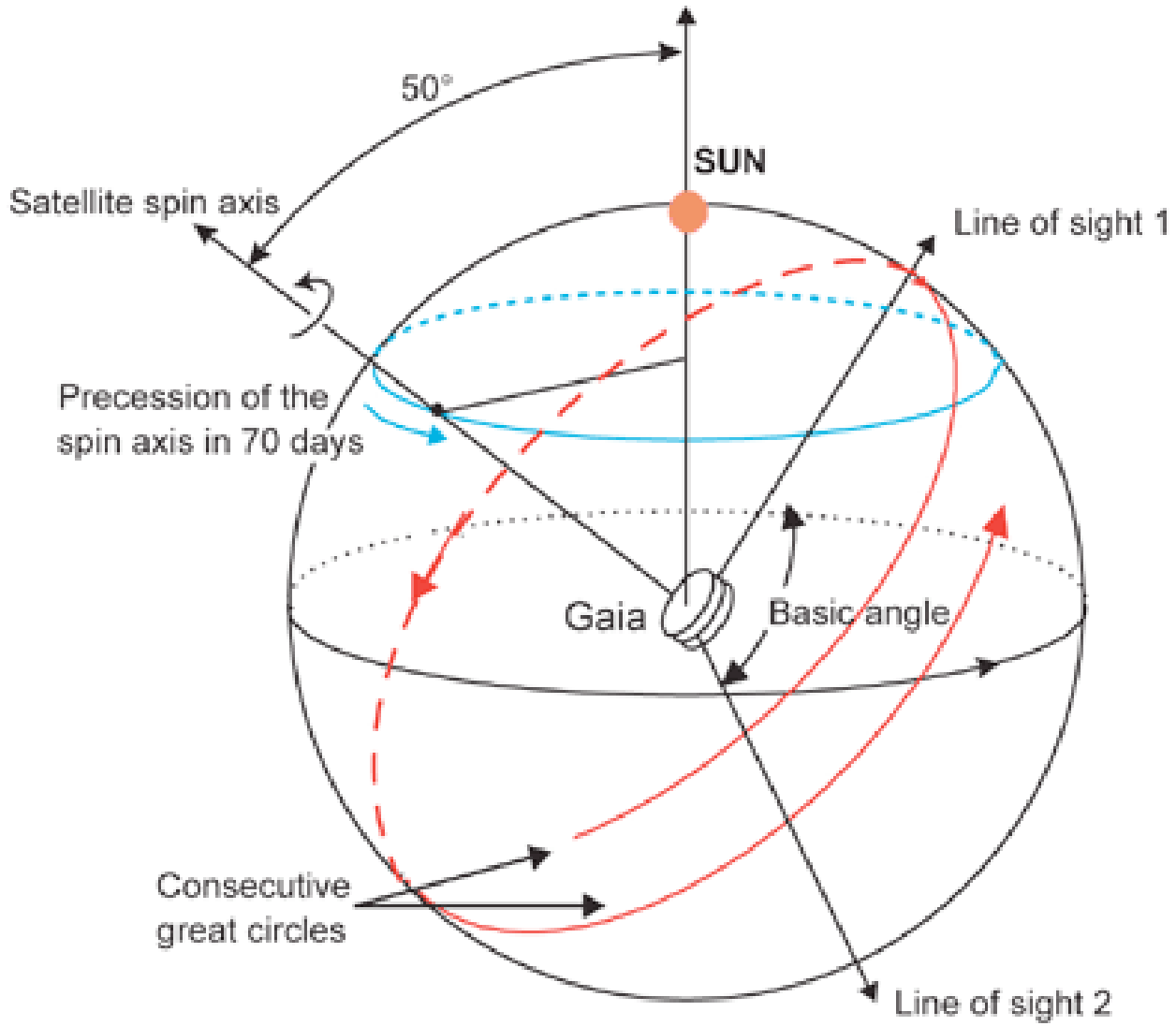
Plan of the talk

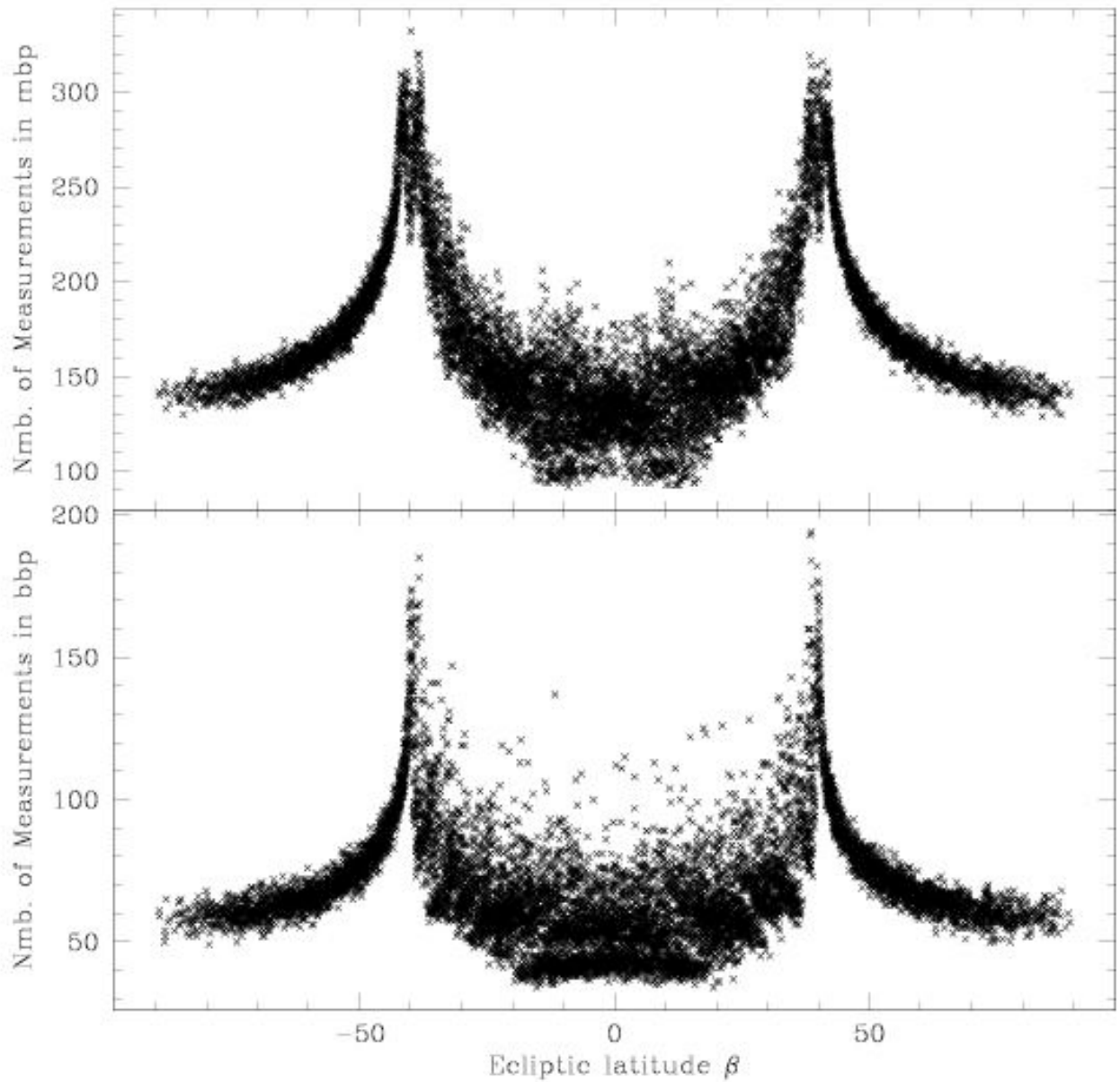
- GOAL : To understand the effect of the sampling law
- Sampling law description (Time series, two fields, MBP, photometric precision)
- Period search algorithms
- Simulations
- Rate of correct detection

The sampling: General view

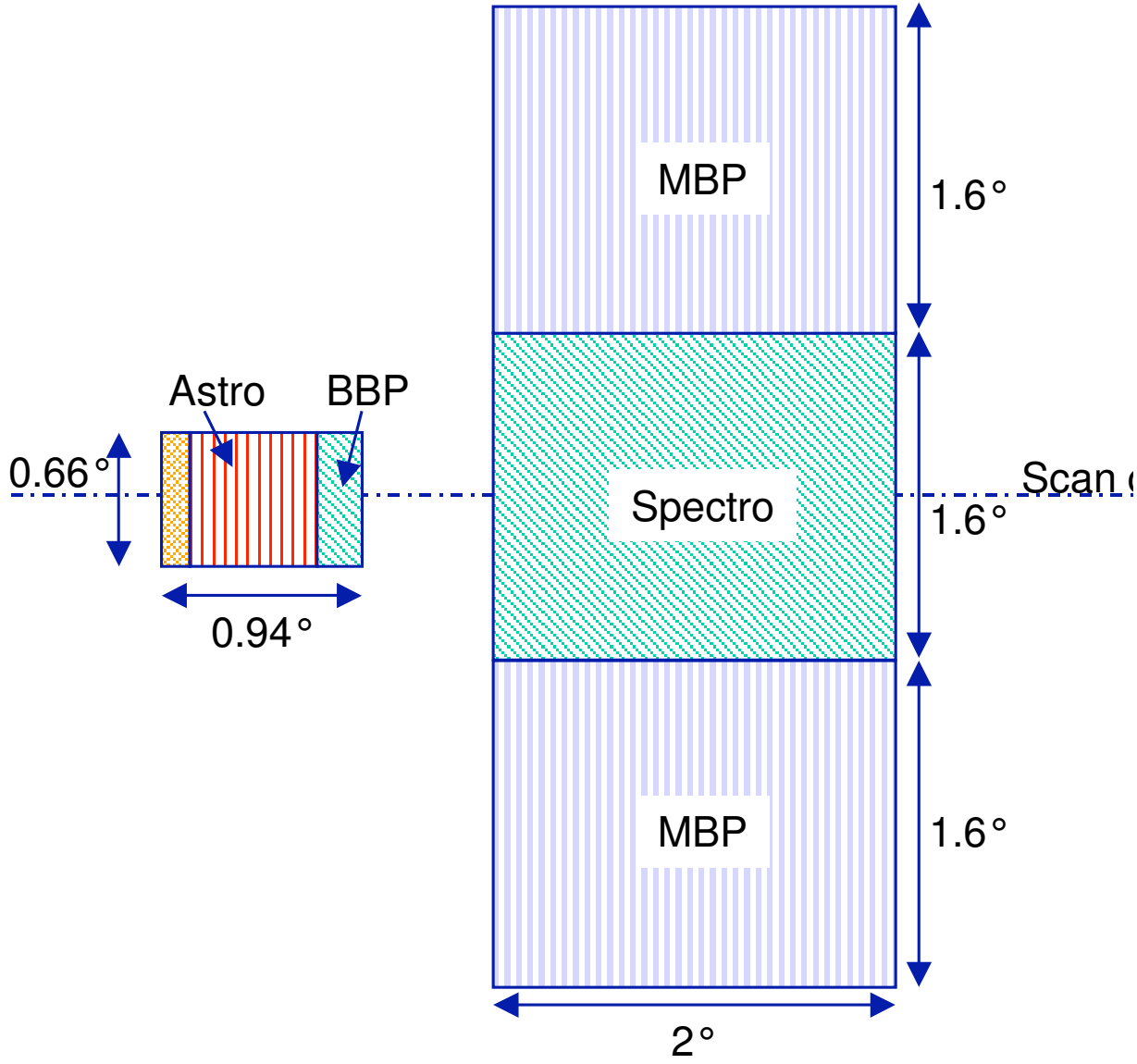


Ecliptic coordinates, lambda and beta

Number of measurements



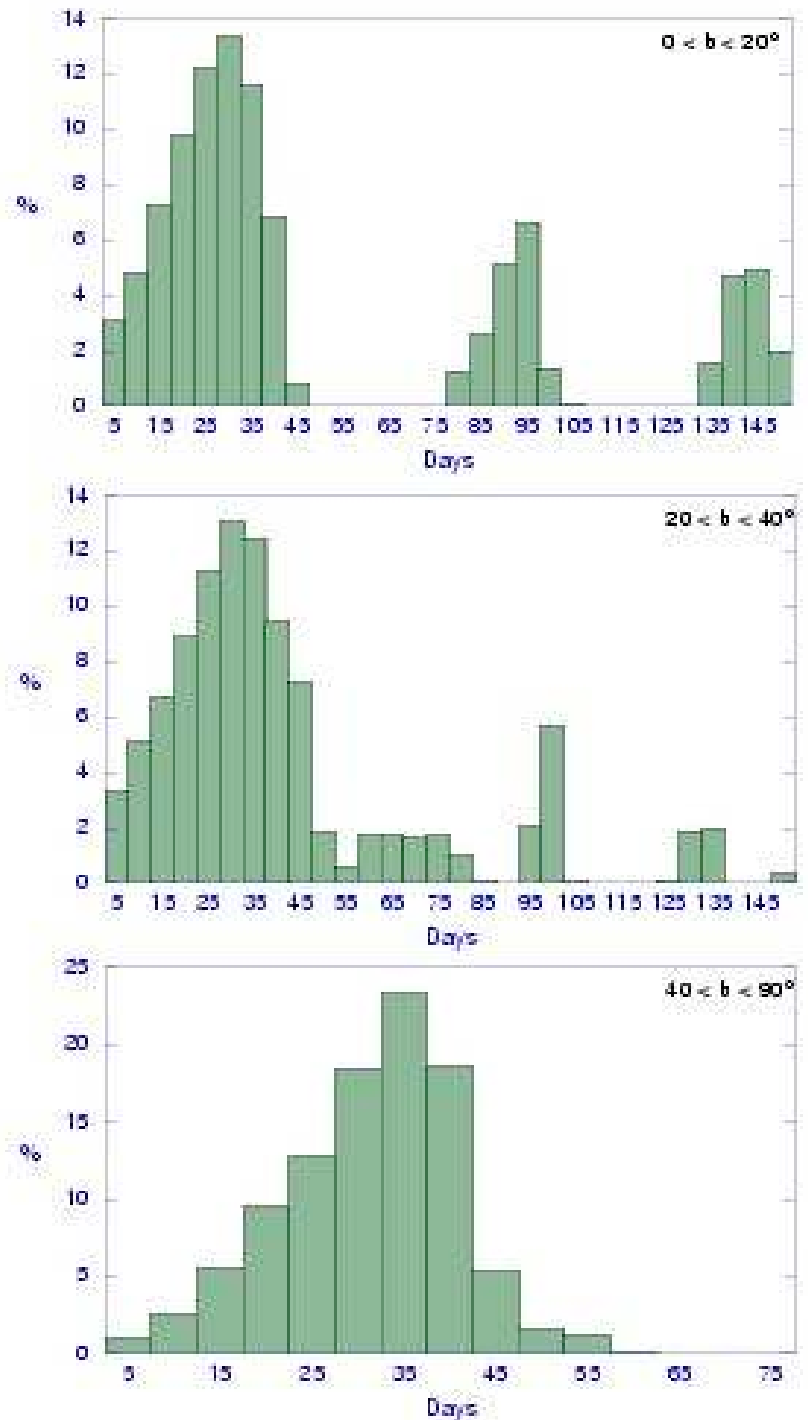
FOV and their relative sizes



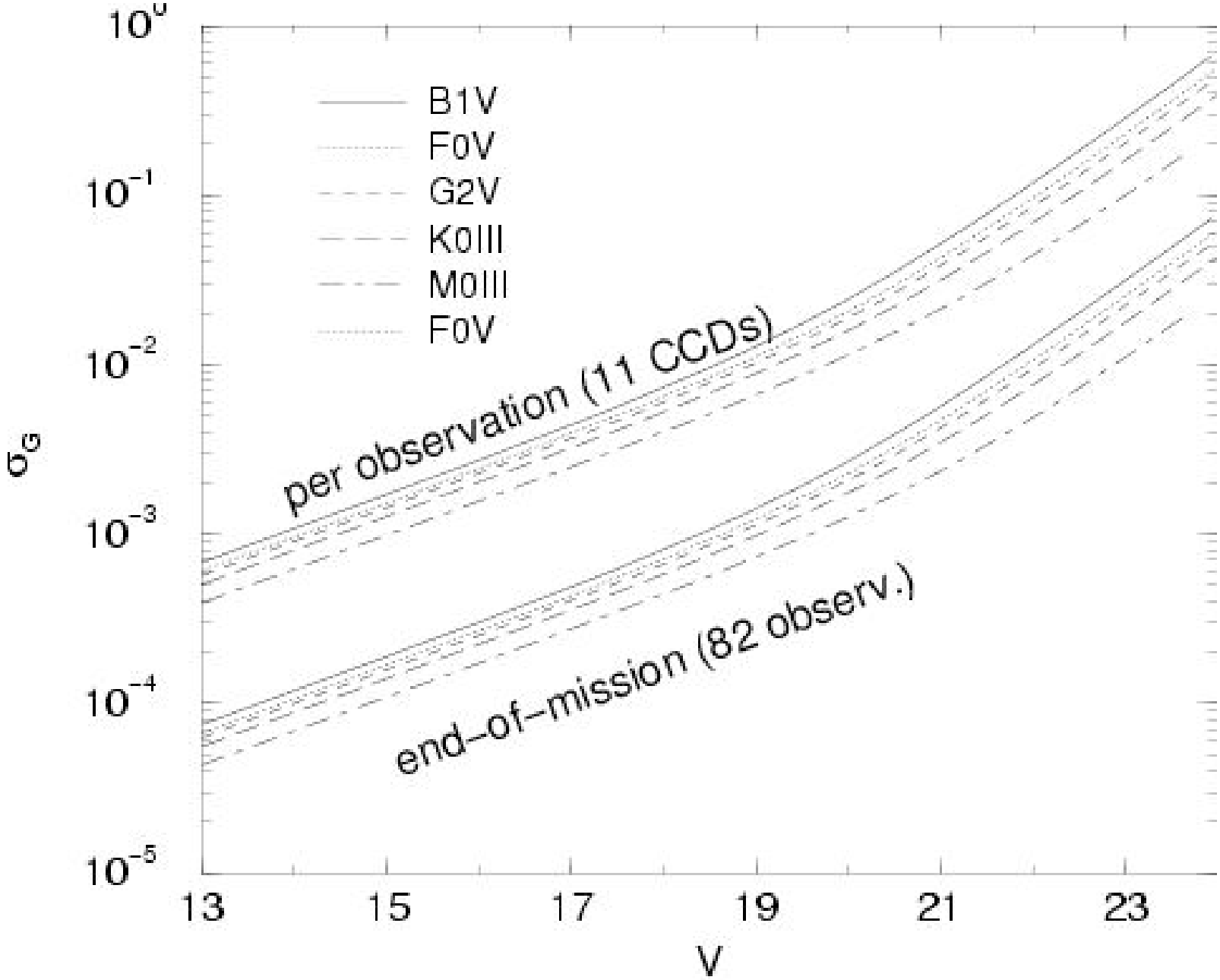
Short Time Intervals

Initial field	Final field	Interval days
PFOV	FFOV	0.074
PFOV	MBP	0.224
PFOV	PFOV	0.250
FVOV	MBP	0.150
FFOV	PFOV	0.176
FFOV	FFOV	0.250
MBP	PFOV	0.026
MBP	PFOV	0.100
MBP	MBP	0.250

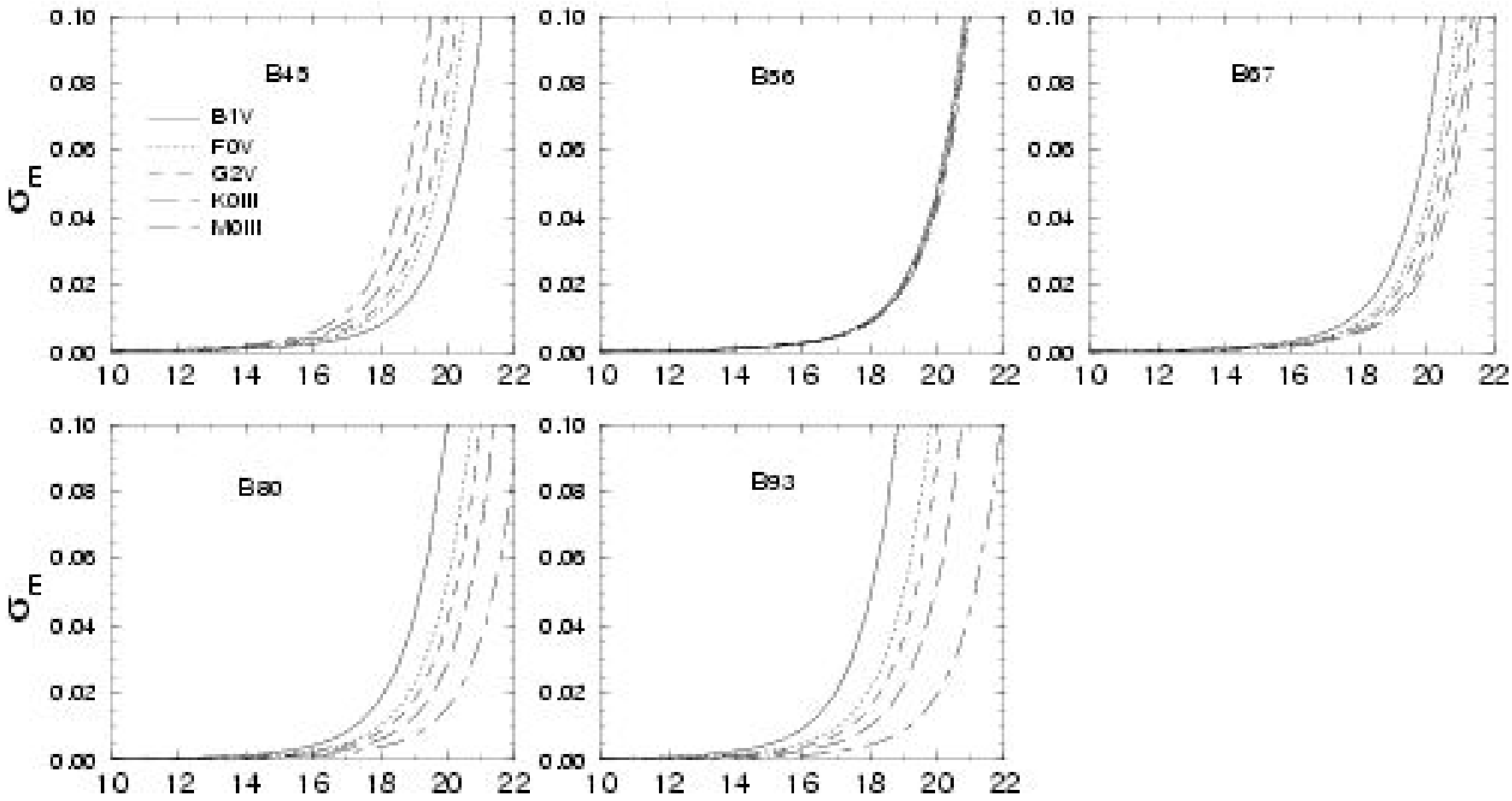
Long Time Intervals



Photometric Precision G mag



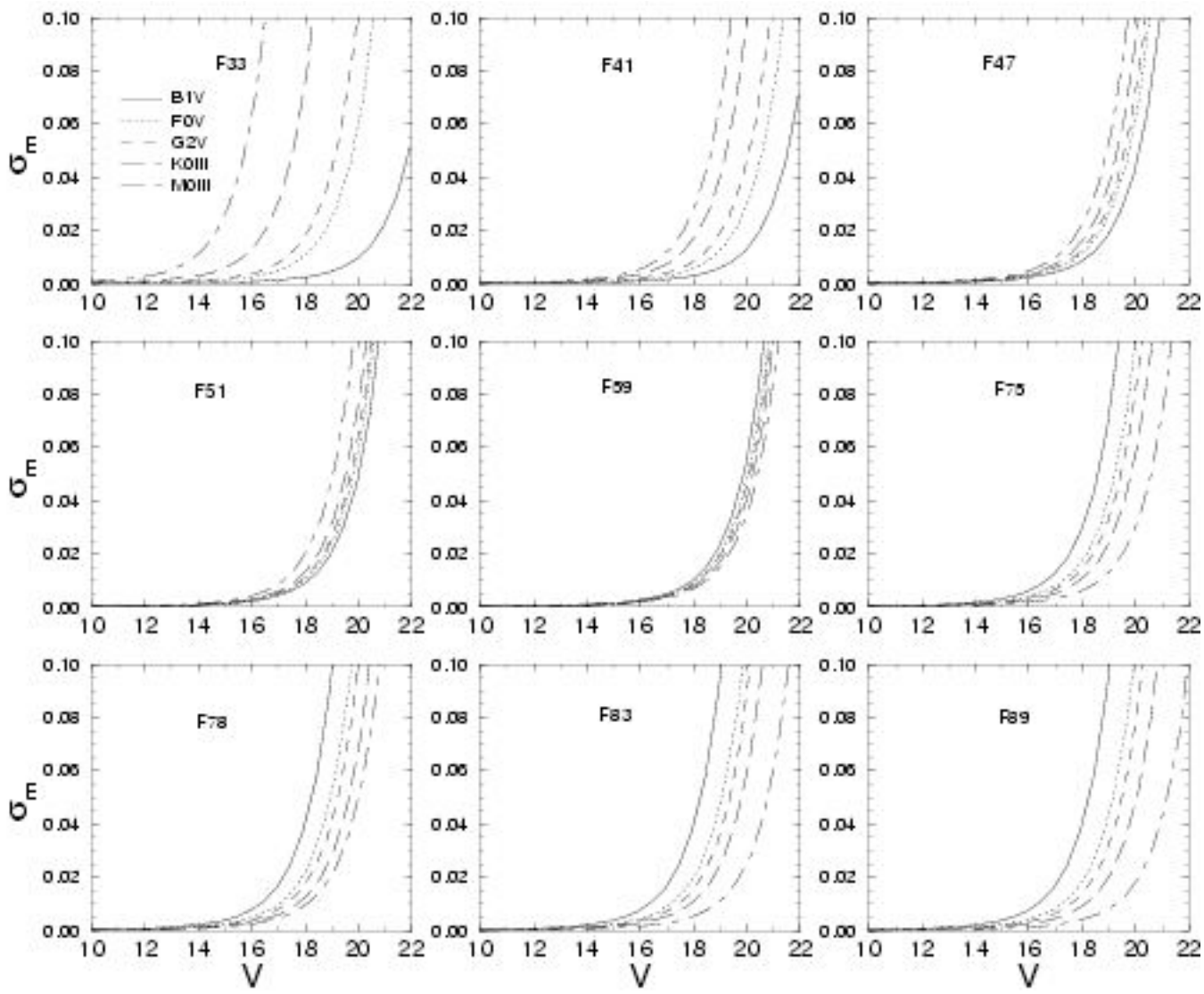
Photometric Precision: BBP



Mean precision on 82 transits

Precision should be soon expressed per transit

Photometric Precision: MBP



Mean precision on 200 transits

Reminder I: Period search methods

List of period search of search methods (14 methods)

http://obswww.unige.ch/~eyer/VSWG/tools.html

- Fourier
- String
- Analysis of variance

Two fast methods: Press (Lomb), Kurtz

- Photometric Accuracy

Specific tools for variability treatment

- **Periodicity**

Fourrier transform: - F. Mignard (2004): algorithm FAMOUS

- Deeming, 1975, Ap&SS 36, 137 (1976, Ap&SS 42, 257)
- Lomb, 1976, Ap&SS 39, 447
- Scargle, 1989, ApJ 343, 874
- Ferraz-Mello, 1981, AJ 86, 619
- CLEAN, Roberts et al., 1987, AJ 93, 968
- Press et al. (faster) http://lib-www.lanl.gov/numerical/bookfpdf.html Section 13.8
- Kurtz (faster) 1985, MNRAS 213, 773

String method

- Lafler & Kinman, 1965, ApJS 11, 216
- Renson 1978, A&A 63, 125

ANOVA

- Jurkevich 1971, Ap&SS 13, 154
- PDM, Stellingwerf, 1978, ApJ 224, 953
- Schwarzenberg-Czerny 1989, MNRAS 241, 153

Wavelets:

- Foster 1996, AJ 112, 1709
- Otazu et al., 2002, MNRAS 333, 365

- **Time-scales**

  Structure functions
  - Hughes, Aller & Aller 1992, ApJ 396, 469

  Variograms
  - Eyer & Genton, A&AS 136, 421

- **Variability Index**

  Abbe test:
  - von Neumann, 1941, Annals of Math. Stat. 12, 153; 1942 Annals of math. stat., Vol 13, 86

  Stetson (1987)
  Welch & Stetson, 1993, AJ 105, 1813

- **Autocorrelation:**

  Bartholdi, 1988, Compte rendu des Journee de Strasbourg 10, 77
  Edelson & Krolik, 1988, ApJ 333, 646

Reminder : Period search II

- Width of peaks (1/deltaT)
- Highest frequency (Nyquist frequency, Eyer & Bartholdi 1999)
- Convolution of the spectral window
- Noise (1/sqrt (n)) versus Amplitude
- Number of independent frequencies, n
  - Horne & Baliunas 1986 (estimation of n)
  - Kuschnig et al. 1997 (estimation of noise from spectrum)
  - Koen & Eyer 2001 (permutation of magnitude)

An example: Amplitude vs noise

Amp.: 0.008 mag

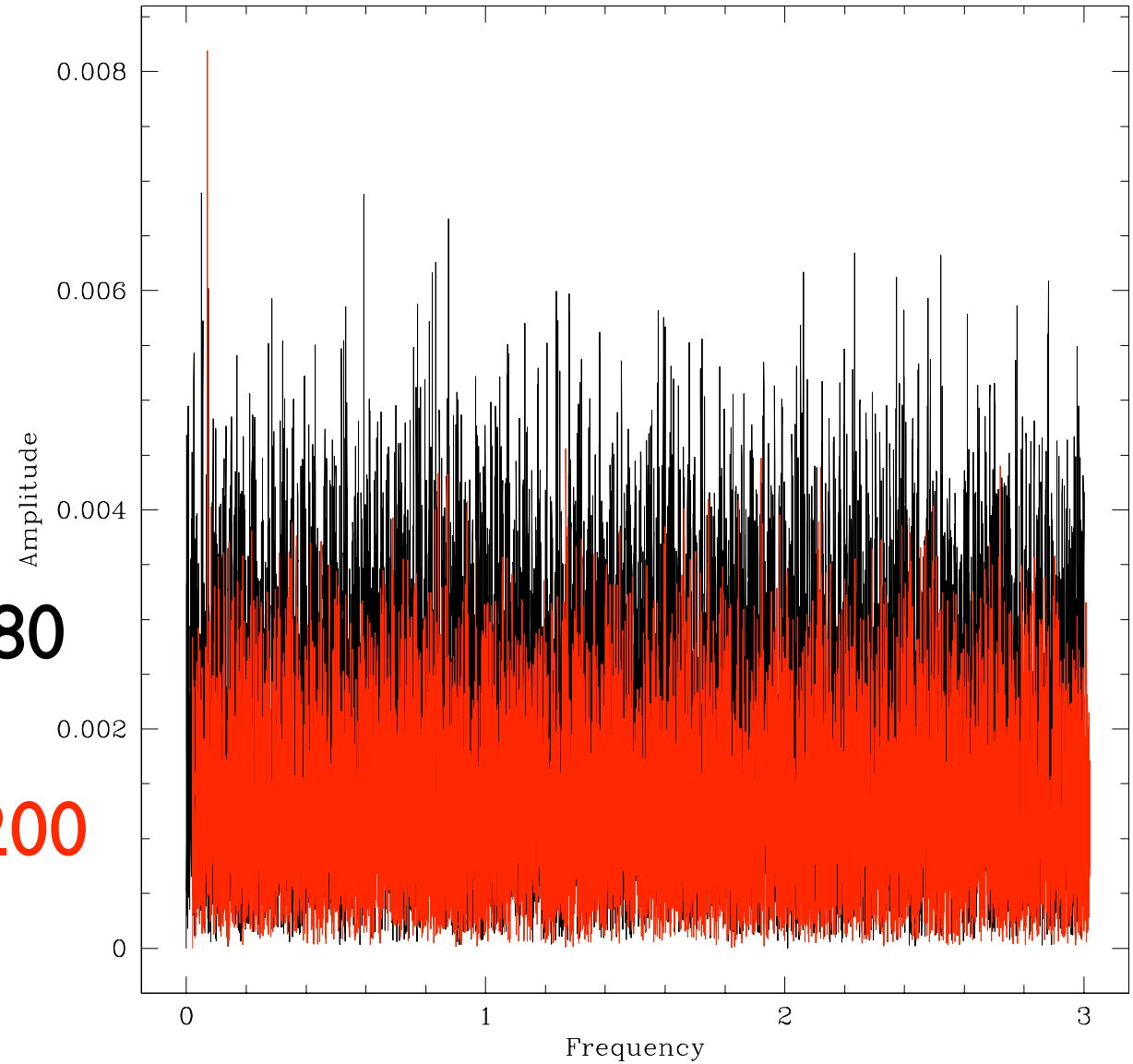
Period: 20 days

Noise/ transit: 0.01mag

n goes up
noise goes down

n~80

n~200



Simulations

Sinusoidal signal:

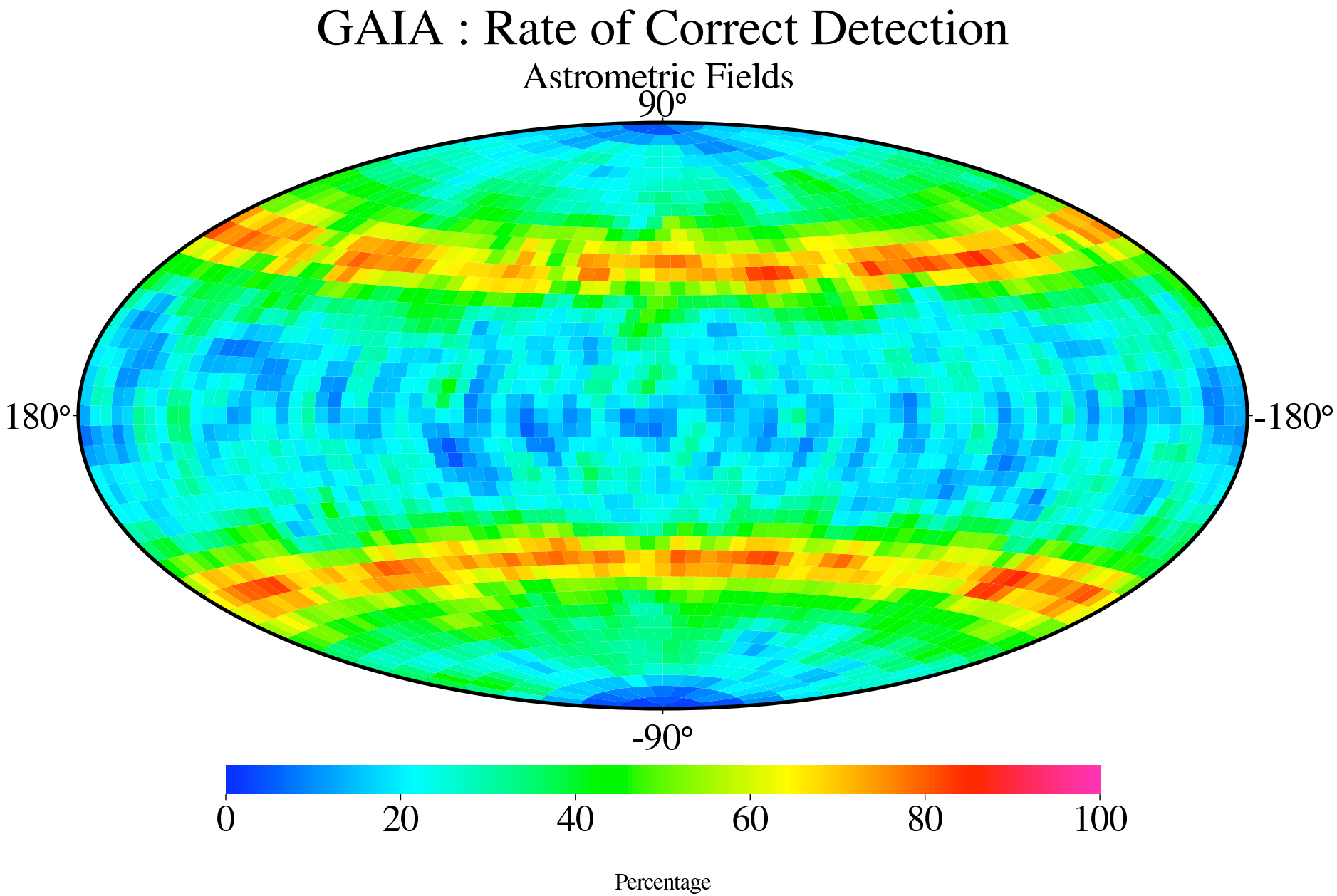
$$signal(t) = A\sin(2\pi\nu t + \phi) + noise$$

noise is $N(0, \sigma)$

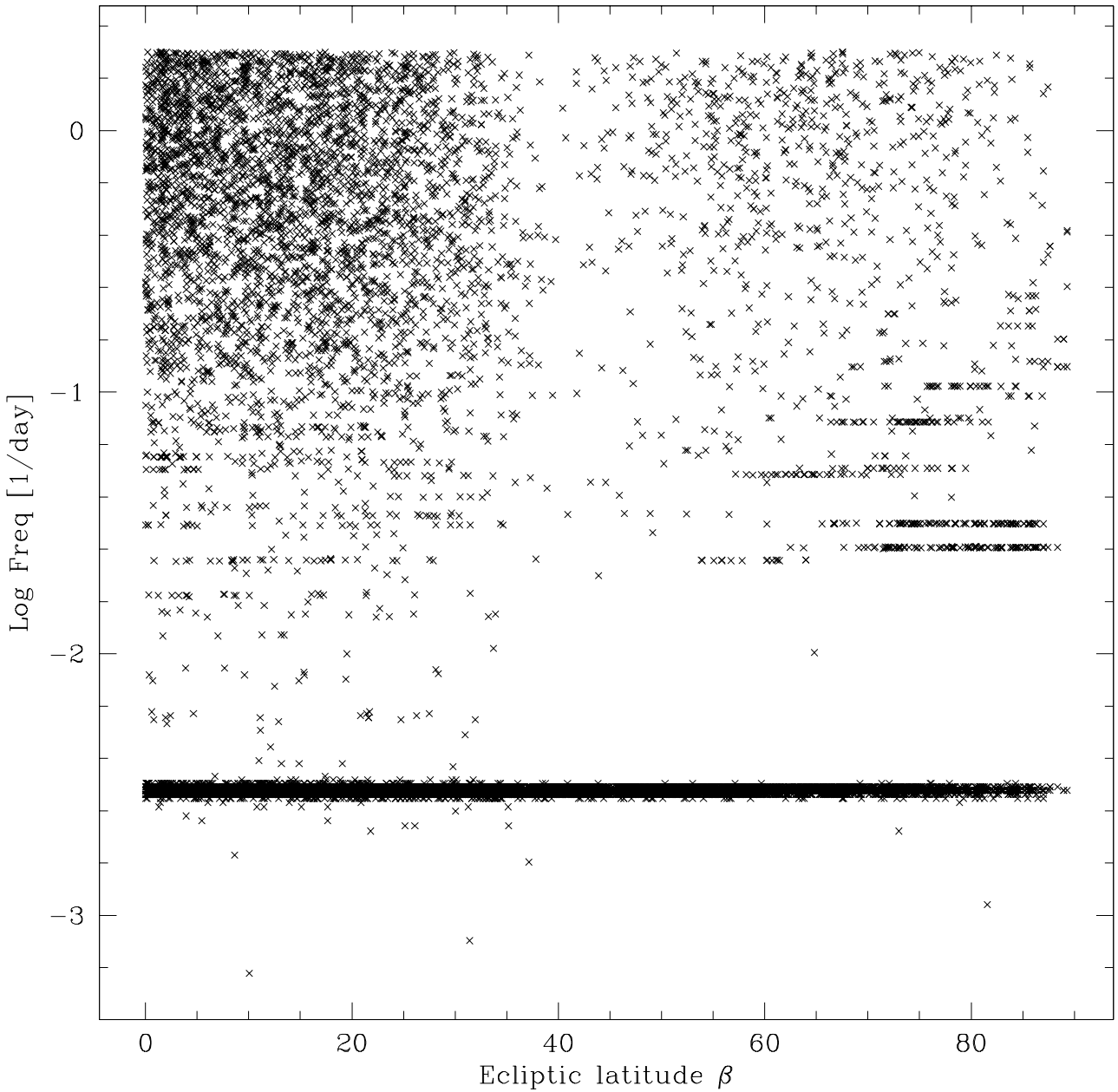
Two parameters:

- signal to noise ratio A/σ
- period

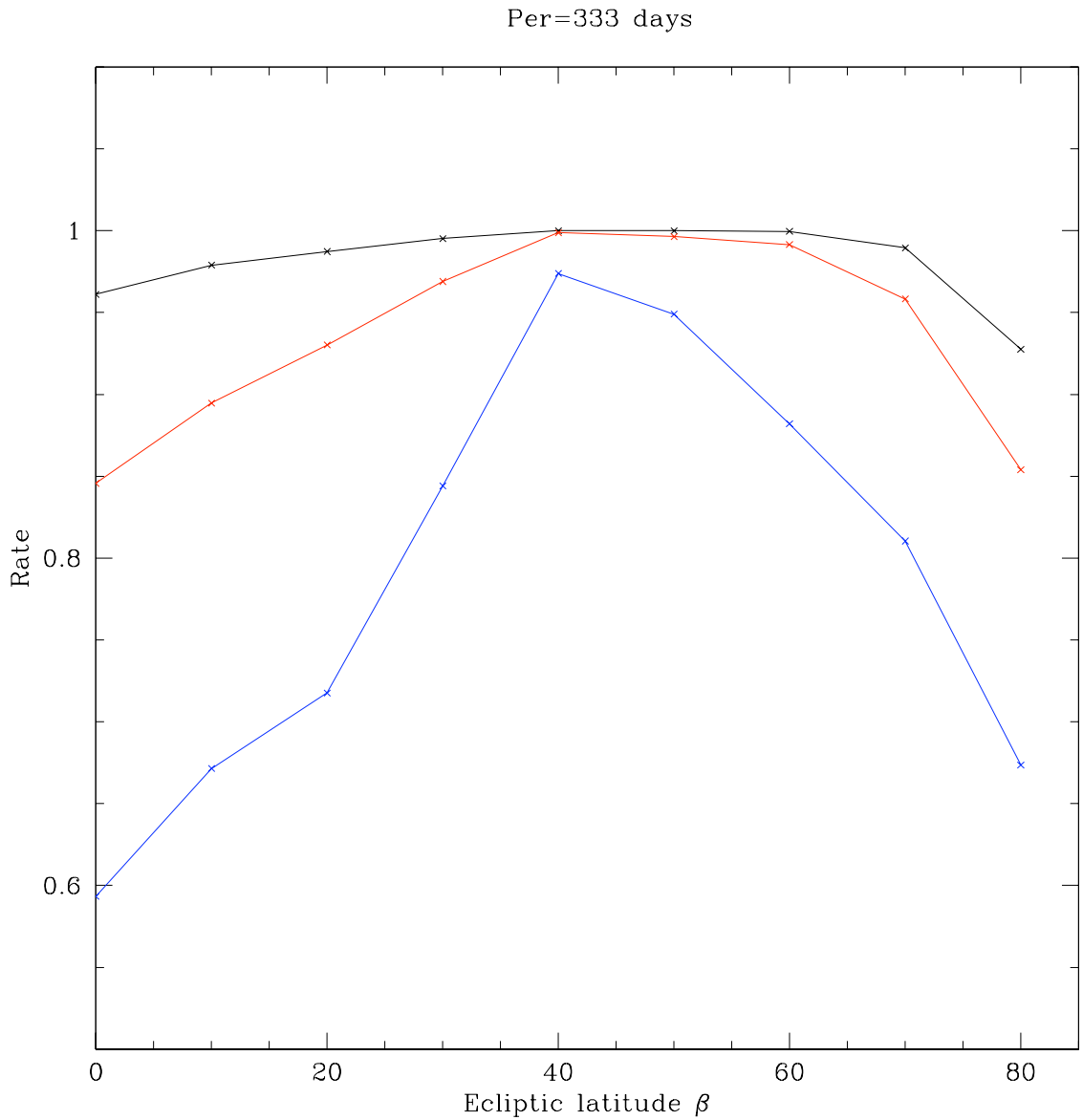
Example: S/N= 0.75, Per=0.2 day



Distribution of Frequencies



Effect of S/N (astro fields)

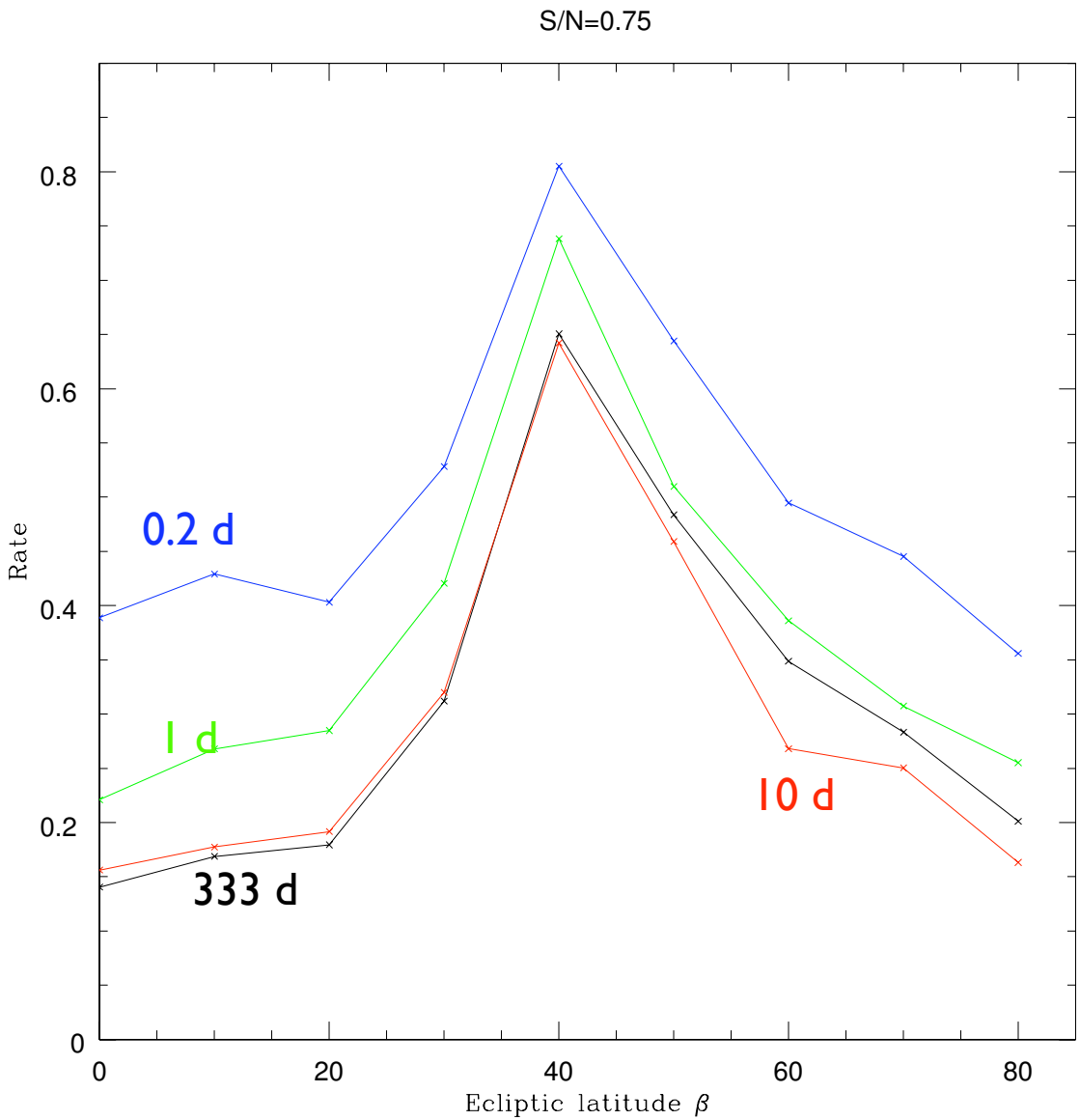


1.5

1.25

1.00

Effect of Period (astro fields)



Work to do

- Use Q=Amplidue/(error/sqrt(n)) (changed)
- Explore grid of Q and periods (underway)
- Simulations for fraction of nominal mission length
- Signal of different shapes