

Fake Crab Nebula/Pulsar data generated to serve as input to EDS for test purposes:

- . This data contains 76346 event timings accurate to a microsecond. Eighty percent is distributed randomly between 0 and 5.00260 seconds and the remaining 20 % constitute pulsed data and bursts.
- . The timings are distributed in 128 channels. Each channel corresponds to 0. 468750 Kev.
- . The basic data used for the Nebula is the one forwarded by Jahoda of GSFC which is in 128 channels and is according to the spectrum $dN/dE = 9.9 E^{-1.1}$ and the detector response including absorption is folded into the data.
- . For 5 consecutive intervals each of ~ 1 second (Accurately 1000260 microseconds) faked pulsar profiles of varying shapes and amplitudes are added to the data . The pulsar period used is 33.342 ms. A pulsar burst of one second duration is added during the third second..
- . A four millisecond long large burst not associated with the pulsar is also included.

Figures:

Fig 1. Time Series for energy channels 5-22 corresponding to 2-10 Kev . The time interval chosen is 1.1114 milliseconds, which is convenient for pulsed data fabrication.

Fig 2. Similar Time Series for the 10-30 Kev range.

Fig 3. Channel wise distribution of the total counts

Figs 4 and 5 The profiles of the pulsar from the entire data for the two energy ranges

Figs 6 and 7 Successive Pulse profiles for each second of data for the two energy ranges

If this data is fed to EDS as input what one should expect at the output is as follows :

- 1.Channel wise distribution of counts (Fig 3)
- 2.Time Series (Figs. 1 and 2)
- 3.The Fourier Transform should reveal a periodicity of 33.342 ms.
- 4.Fast Folding of the data with this periodicity should reproduce the pulse profiles of Figures 4,5,6, and 7
- 5.The Burst Catcher should catch the burst associated with the pulsar (Figs 1,6 and 7) and the isolated millisecond burst (Fig.1)

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burst (Fig.1)

In the light of recent developments in the fields of X-ray and Gamma Ray astronomies (after Ginga, Rosat, Sigma, Comtel) and also developments in the still higher energy astronomies Tev and Pev, the types of problems that can be investigated with advantage using the XTE large area counters (6000cm²,) time resolution of microseconds and onboard facilities for histograms, FFT, Time Folding, Burst Searcher and the ASM and HEXTE are:

1. Extension of time variation studies of sources like ScoX-1, CygX-1, Crab, to submillisecond range
2. Time variation studies of Extragalactic sources in the time range of seconds to minutes (Some Extragalactic sources have shown variations in X-rays in less than a minute without corresponding variations in the optical band -V Ginga results)
3. Studies on the correlation of intensities of the main and interpulses in pulsars like the Crab to establish whether the pulsed emission is from both the poles or is confined to only one pole.
4. Search for microbursts in the submillisecond range during the pulsations (Tev observations of Crab Pulsar indicate the possibility of such pulsed microbursts)
5. Detection of millisecond X-ray Pulsars especially in the Globular Clusters.
6. Detection of pulsed line emissions (Ginga had detected Pulsed Iron line emission from CenX-3)
7. Search for Transient sources- Ginga Transients which start out at tens of Crab level and persist for 40-50 days at intensity levels higher than the Crab and decay rapidly
8. Aperiodic variability of sources down to milliseconds .
9. Search for Transient Pulsars (Seven of the Pulsars picked up by Ginga are transient)
10. Study of Cyclotron line features, the steepening of the spectra in Binary Pulsars at high energies
11. Spectral studies of AGN's, Seyferts, Quasars, --Iron line features and spectral behavior beyond certain energies
12. Search for the Pulsar in 1987a which is expected to show up in X-rays by 1995
13. Detection of short duration bursts milliseconds to seconds

(the list to be continued)

** The X-ray sources that have shown up occasionally at very high energies of Tev and Pev are : ScoX-1, HerX-1, CygX-3, PSR1957+20, Vela Pulsar, Cas Gamma-1, CenX-3, AE Aqr, and the Extragalactic source MK 421

The Crab Nebula is the only source that has been established ~~steady~~ as a steady emitter in the Tev range at a high significance level.

Pulsations are however seen occasionally from Crab both in the Tev and Pev ranges.

*

PCA 6000 cm² ; Crab Nebula counting rate =10,000/Sc

If the G-Transient starts off say at 10 Crab,
the PCA counting rate is ~ 100,000 /Sc or 100/millisecond.

Let us search for a 10 millisecond pulsar with 2 millisecond pulse width
in this source and see at what level of Crab intensity we can detect at 5 Sigma level
in say, 100 seconds observation

Number of millisecond Phase Bins : 10

Number of counts per millisecond Phase Bin (100 seconds Observation)

$$100,000 \times 100 / 10 = 10^6 \text{ or one million}$$

1 Sigma = 1000 ; 5 Sigma in each of two successive bins = 10,000

10,000 counts in Pulsar in 100 seconds. or 100 counts/sc.

Intensity of Crab in PCA = 10,000/Sc.

New pulsar intensity at detection will be one milli Crab.

The limit that can be set on pulsations is ~ 1 / 10⁻⁴ of the source.

Some transients like A0620-00 may start with intensities of ~ 100 Crab.

To establish that these are Black Hole candidates it is necessary to
rule out Pulsations from these sources.

Cygnus Simulations

The Cygnus simulations have been done in two parts;

Part A : Timings accurate to a microsecond are simulated for 25 seconds exposure with PCA. The random time arrivals are distributed into five counters, into 128 energy channels. Several 100 to 150 millisecond duration bursts have been incorporated. The weighting is per Spectrum of Cyg X1. The counter response is folded into the data.

This should serve to check the performance of the Burst catcher.

Part B : All the counts from Cygnus ^{is} treated as coming in the form of bursts; singles, doubles, triples, fours and fives. The multiples are all within ten microseconds. Since a single counter may not have the requisite resolution, it is ensured that the multiples are always in different counters. The data is distributed in 128 channels as above.

This should serve to check whether the EDS records and analyses the burst data with time resolutions of less than ten microseconds.

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- 5.The Burst Catcher should catch the burst associated with

Timeseries for Crab Nebula + Pulsar + Bursts

2 - 10 KeV

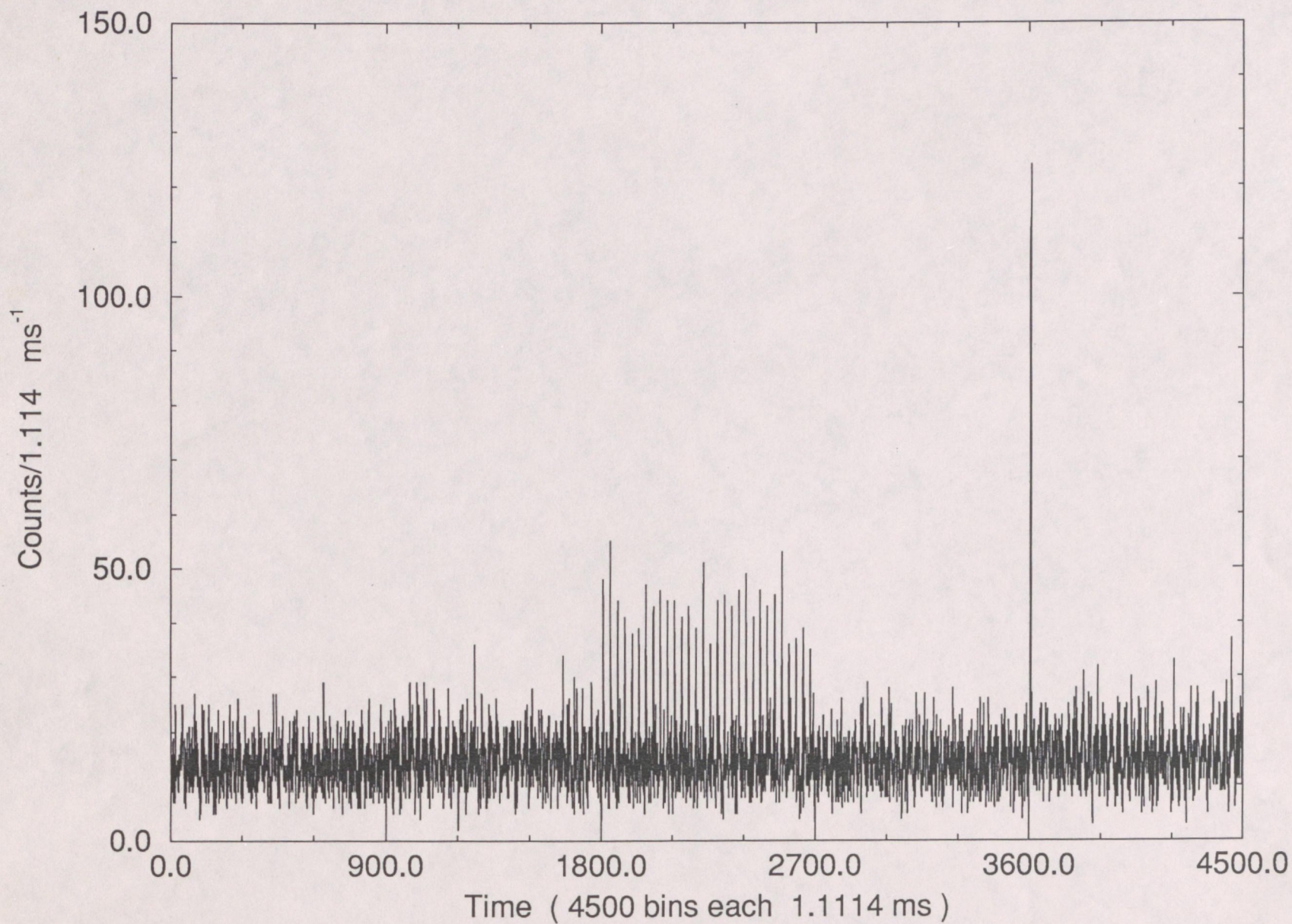


Fig 1.

Timeseries for Crab Nebula + Pulsar + Bursts

10 - 30 KeV

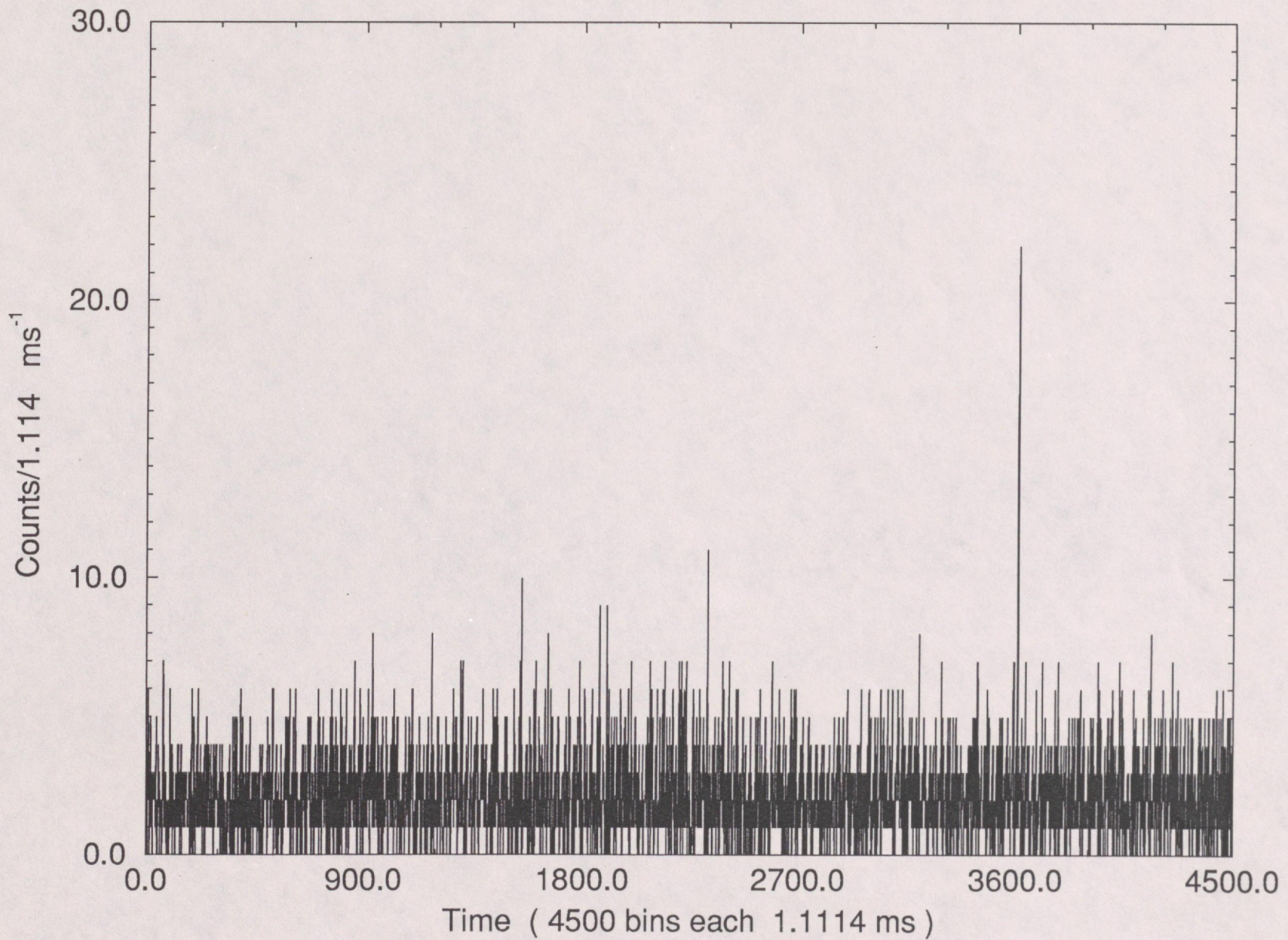


Fig 2.

Response of counter

assumed for simulation

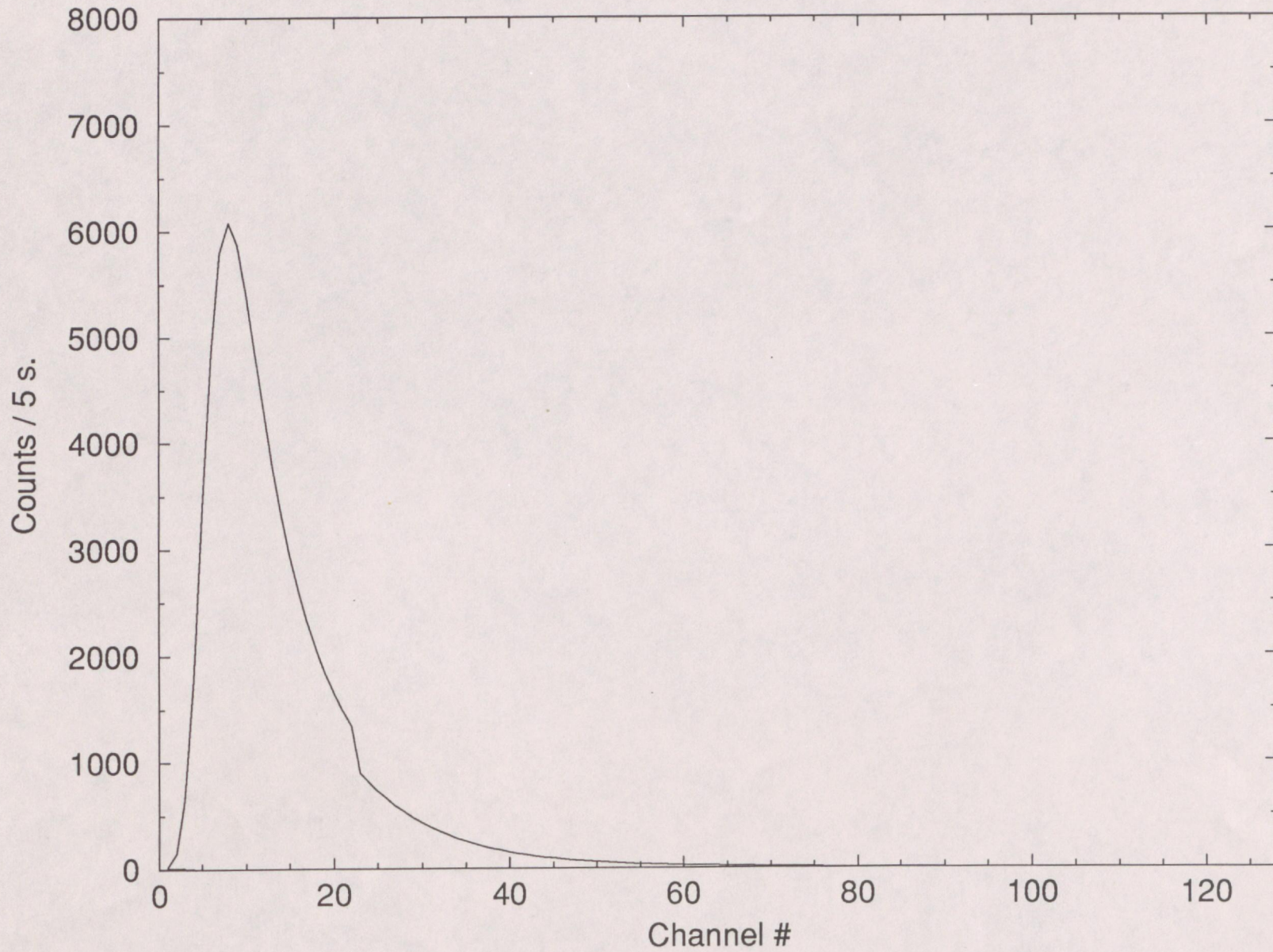
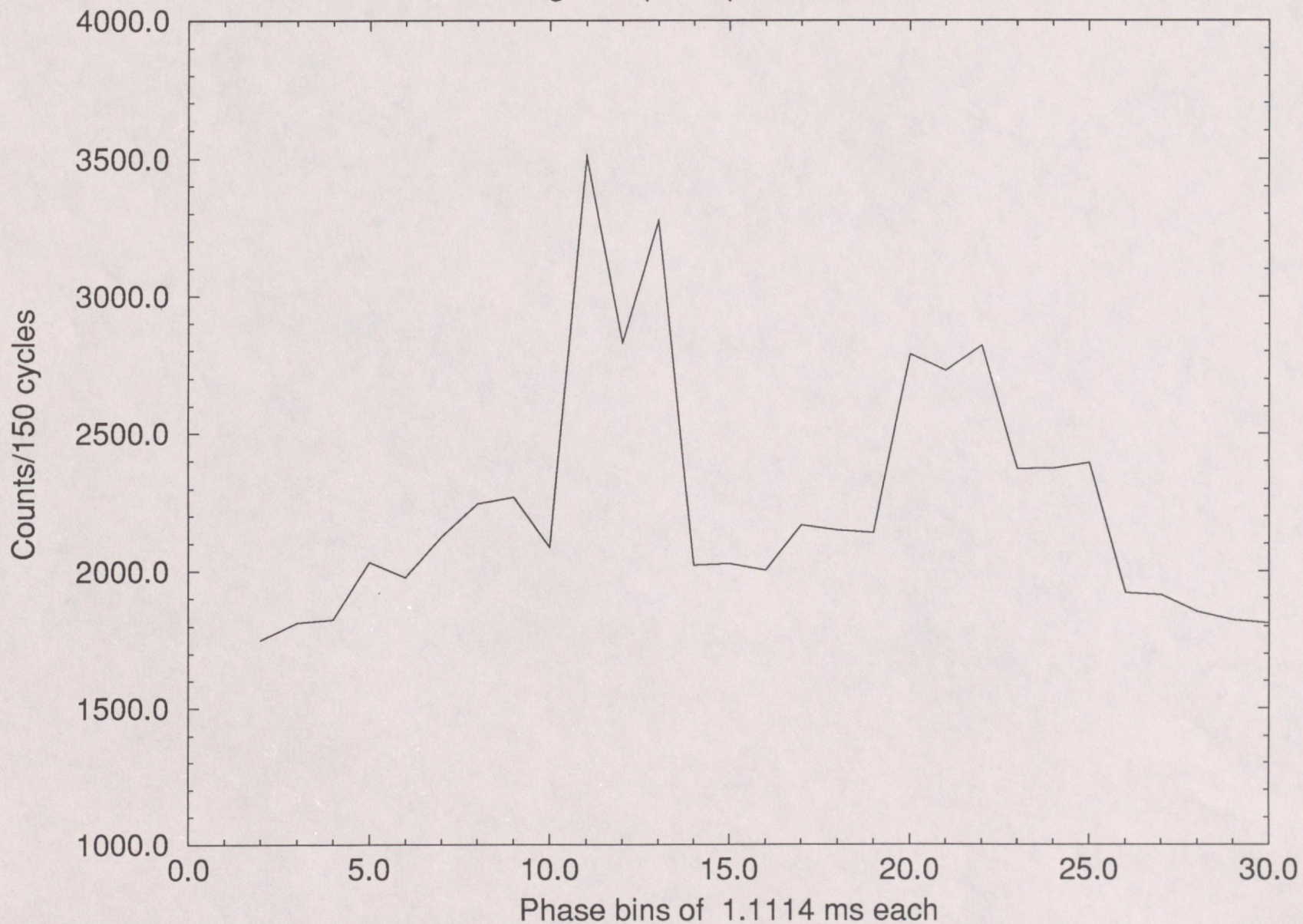


Fig 3.

Crab pulsar + background + bursts

Integrated pulse-profile : 2-10 KeV



Crab pulsar + background + bursts

Integrated pulse-profile : 10-30 KeV

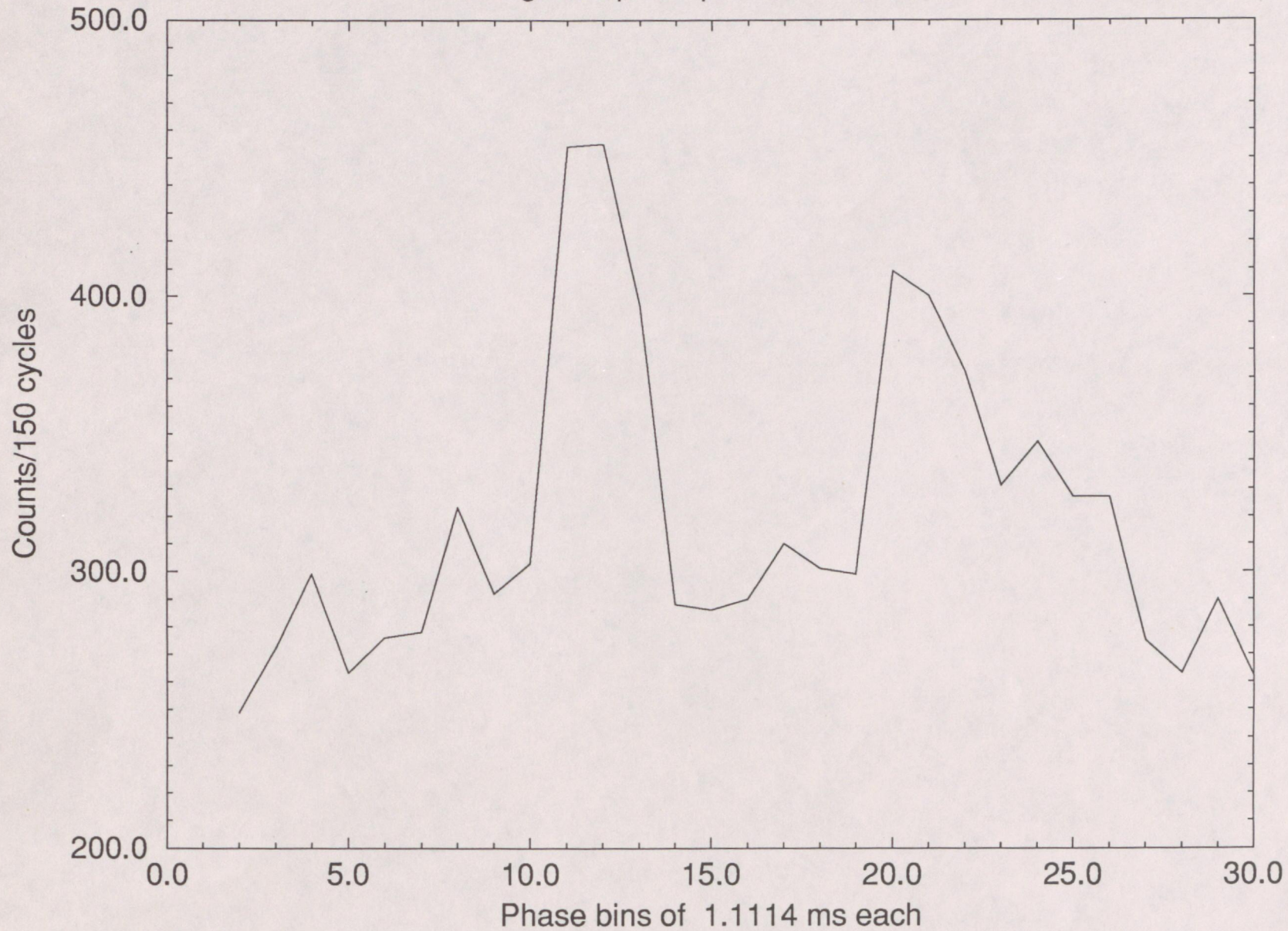
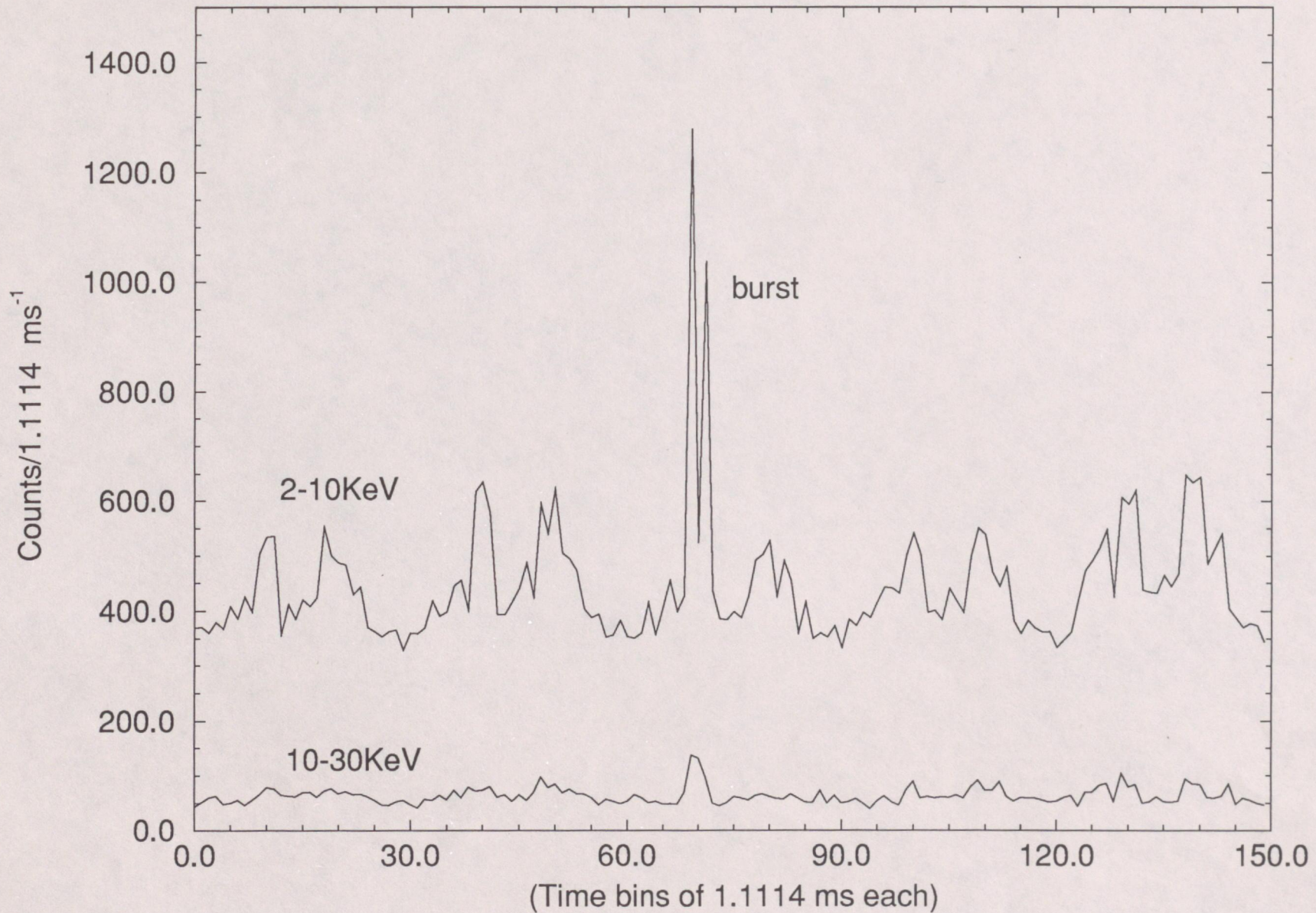


Fig 5

Successive Pulse-profiles + Background



Successive Pulse-profiles + background

10 - 30 KeV

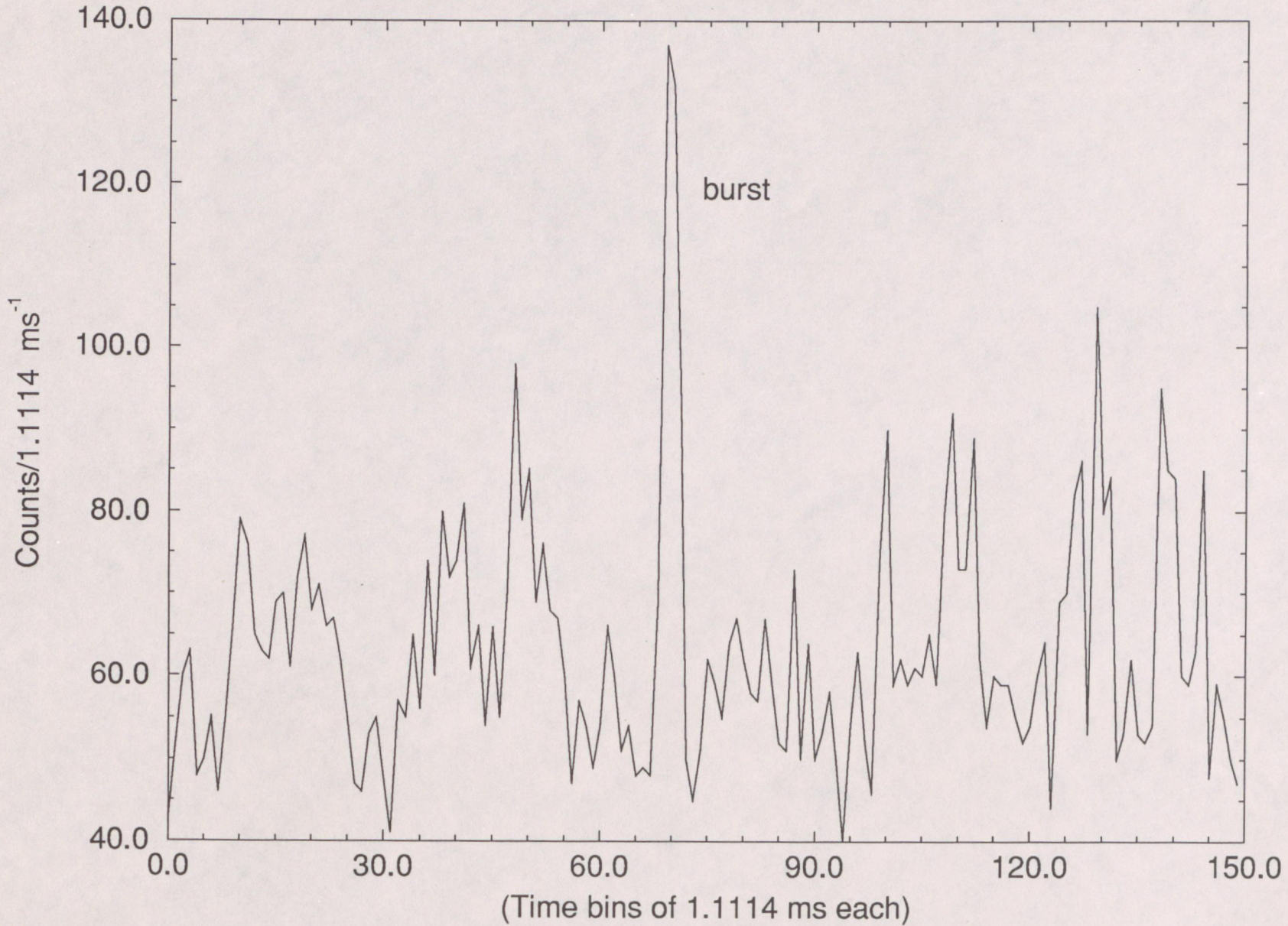


Fig 7.

$$F_{CR}(>E_{GeV}) = 1.55 E^{-1.76} \text{ cm}^{-2} \text{ sr}^{-1} \text{ s}^{-1}$$

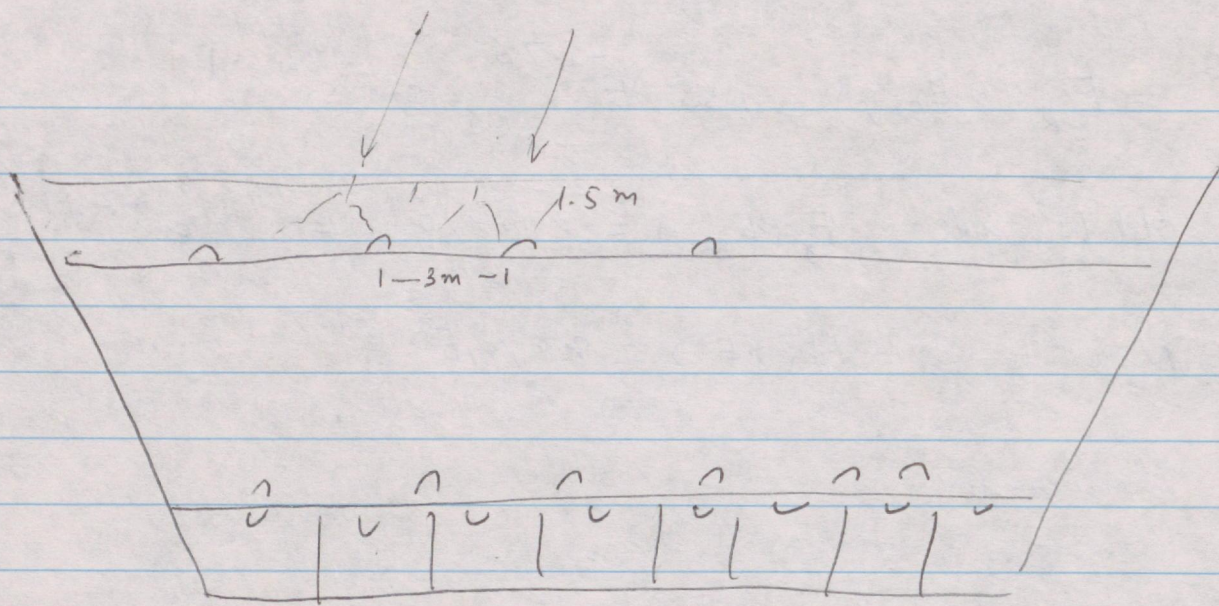
old Whipple $F_{\gamma}(>E_{GeV}) = 3.17 \times 10^{-7} E^{-1.4} \text{ cm}^{-2} \text{ s}^{-1}$

New " $F_{\gamma}(>E) = 8.87 \times 10^{-7} E^{-1.7}$ "

Thermostocke

7/10

Old



100 GeV

800-235-9292

(darker grey lines)

Mc Growth

IMB m1

$$\alpha = 166^\circ$$

$$\delta = 53^\circ$$

$$\sigma = 25.4$$

IMB km

$$\alpha = 106^\circ$$

$$\delta = 68^\circ$$

$$\sigma = 24.7$$

$$\phi_{\mu} \approx 4.65047 \times 10^{-11} \mu / \text{cents.}$$

$$2 \times 10^{-5}$$

$$8 \times 10^{-4}$$

48,600 km trees.

prominent aug	} $\alpha = 227^\circ$ $\delta = 30^\circ$
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$\alpha = 90^\circ$ $\delta = -30^\circ$
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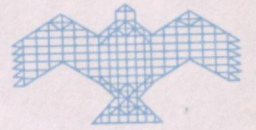
Complete - gets the?

→ expected aug

$$\alpha = 81^\circ$$

$$\delta = 47^\circ$$

	α	δ	
Cyg X-3	20h 31' 55"	40° 54' 29"	X-ray Binary
Her X-1	16h 57' 19"	35° 21' 49"	"
Crab PSR	5h 33' 39"	22° 01' 18"	Pulsar
4U0115+63	1h 15'	63° 30'	X-ray Binary
NGC 1275	3h 18' 48"	41° 25' 0"	AGN
Mk 421	11h 3' 36"	38° 17' 33"	Blazar
3C273	12h 28' 22"	2° 7' 57"	QUASAR AGN
3C279	12h 53'	-5° 31'	" AGN (GRB)
1E2259+586	23h 0' 42"	58° 49' 58 '	SCUDAN SOURCE (XRB)
Geminga	6h 32' 58"	17° 46' 58"	Pulsar
A0535+26	5h 38' 01"	26° 18' 30"	Black Hole Candidate
Cyg X-1	19h 58'	35° 0'	Type II binary
NGC 1068	2h 41' 56"	-0° 4' 30"	BH Candidate.



- Discovery of large number of elementary particles -
Mesons - leptons - quarks.

- The Standard Model of Particle Physics

