FN-295
2060.00

Fermilab

NEUTRINO EVENT RATES AT FERMILAB

H. B. White, Jr.

July, 1976

Predicted event rates for neutrino interactions in a 20 ton target have been tabulated for present beam systems at Fermilab. Some flux distributions used are described in FN-292 by Stefanski and White. The data presented here are events per day per 10^{13} protons on an Al target per 5 GeV bins per 20 tons detector. An accelerator repetition rate of 12 seconds with 10^{13} protons per pulse is assumed. The cross section for neutrino and anti-neutrino interactions used are as follows:

$$\sigma_{\nu} = .6 \times 10^{-38} E_{\nu} \text{ CM}^2$$

$$\sigma_{\bar{\nu}} = .3 \times 10^{-38} E_{\bar{\nu}} \text{ CM}^2$$

These points on the graph which would yield event rates of less than 1 are not shown, as is the case for background in the sign selected triplet beam. Included also are rate predictions for 1100 GeV incident protons on an Al target for various systems.

Calculations of the wrong sign background for Horns with plugs is accomplished by restricting the production angle to lie within the angular region of the plugs for bare target, and subtracting this data from the standard Horns without plugs. The subtraction was

Operated by Universities Research Association Inc. under contract with the Energy Research and Development Administration

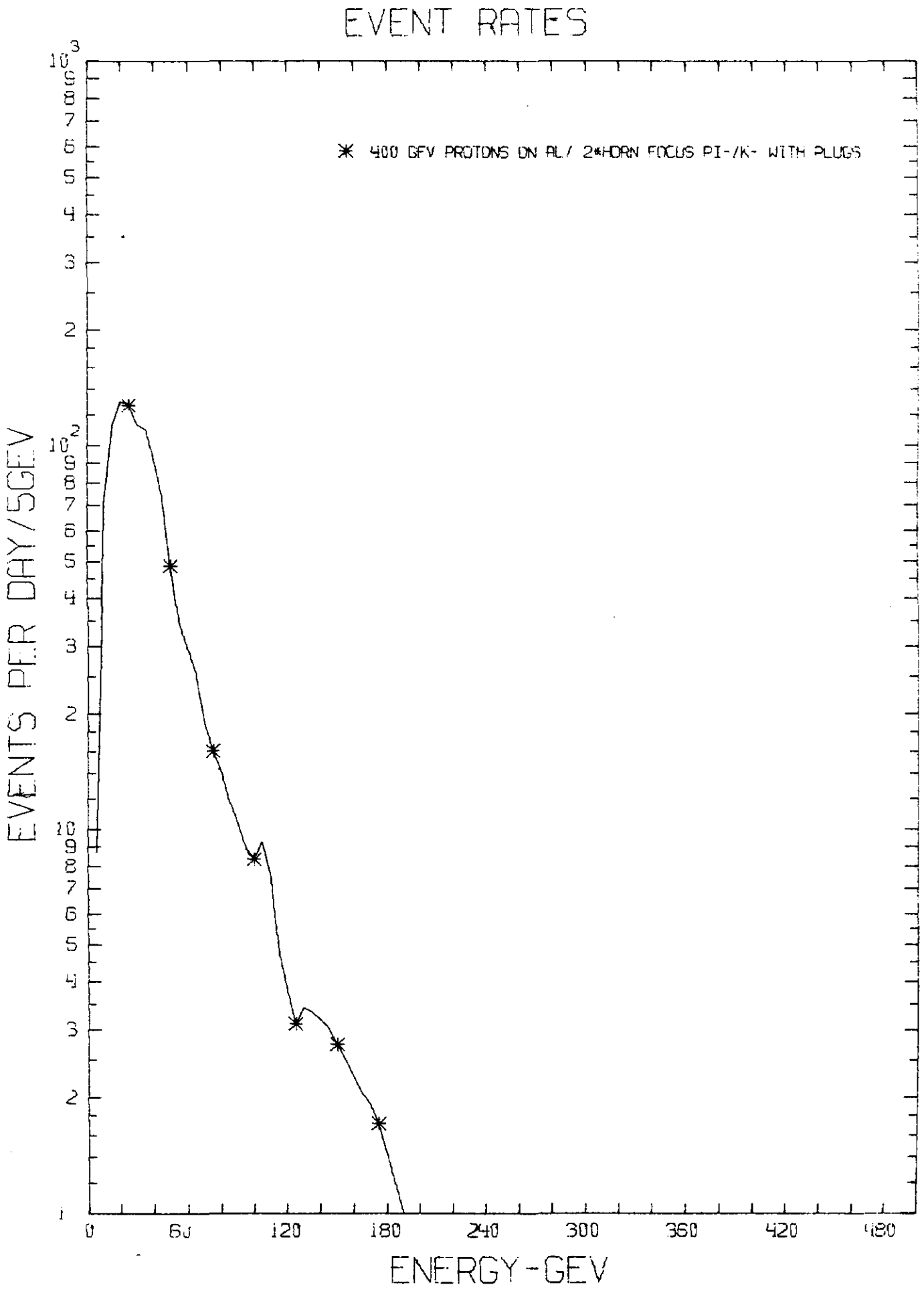
not done, but the data is identified by the label "angle limit".

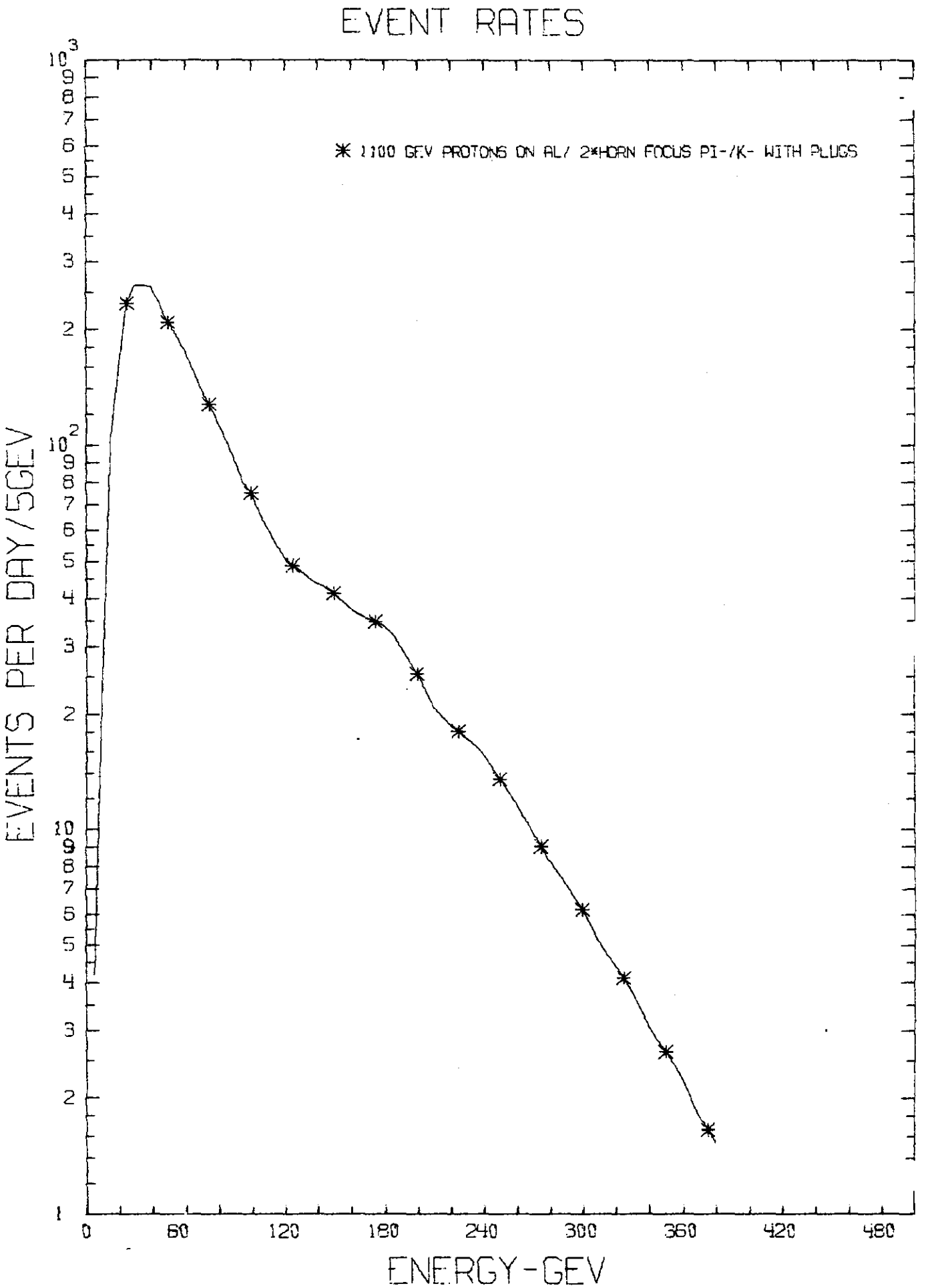
The normalization for this data with the double Horns focussing positives was found to be .626 events/12sec for 5 GeV bins, by integrating over the energy range of 0 to 400 GeV. This is comparable to the event rate observed by Experiment 53A using the 15' Bubble Chamber with the two Horns, which was found to be approximately .8 events per pulse.

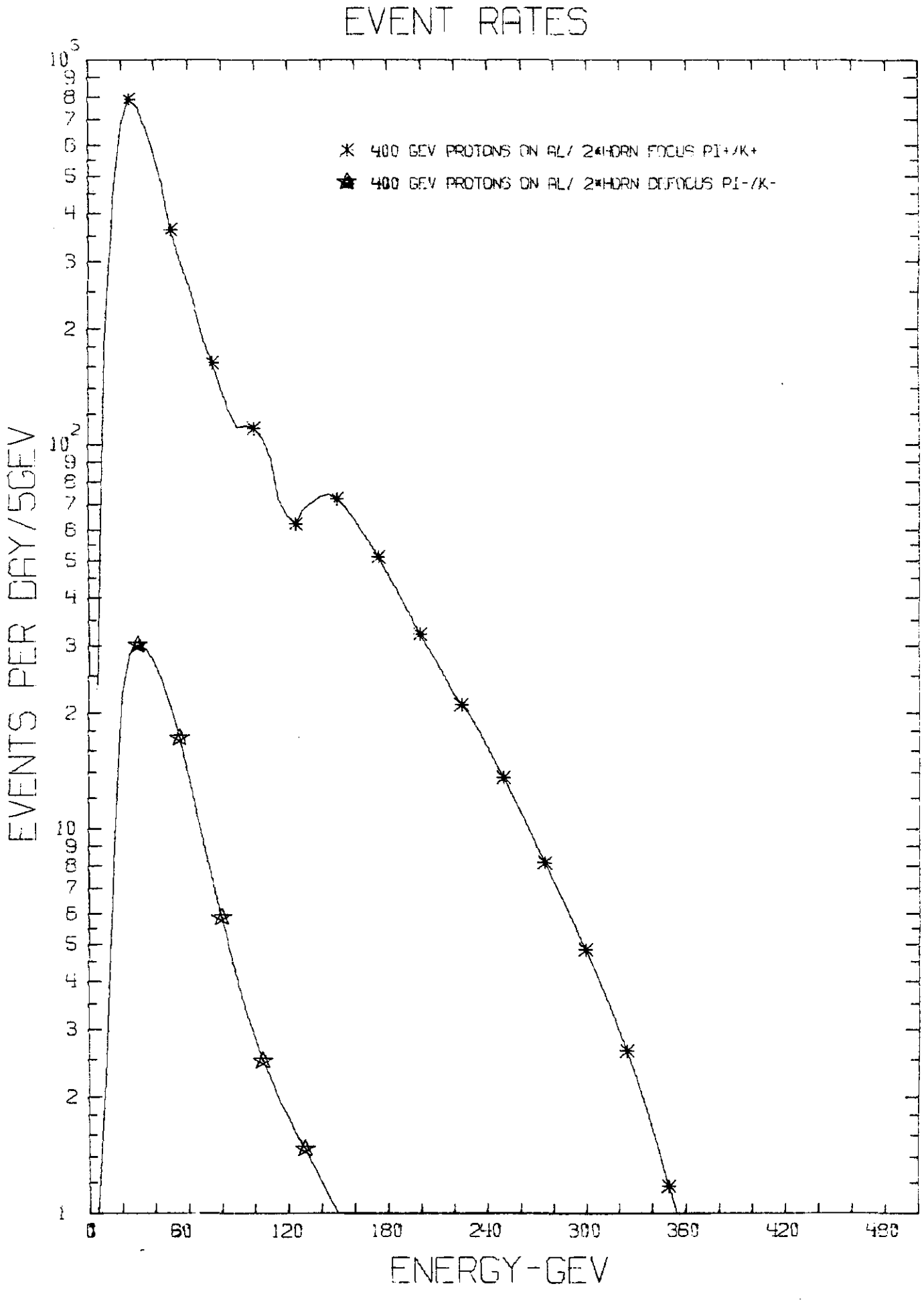
Please note the nomenclature used for describing the various systems in this paper:

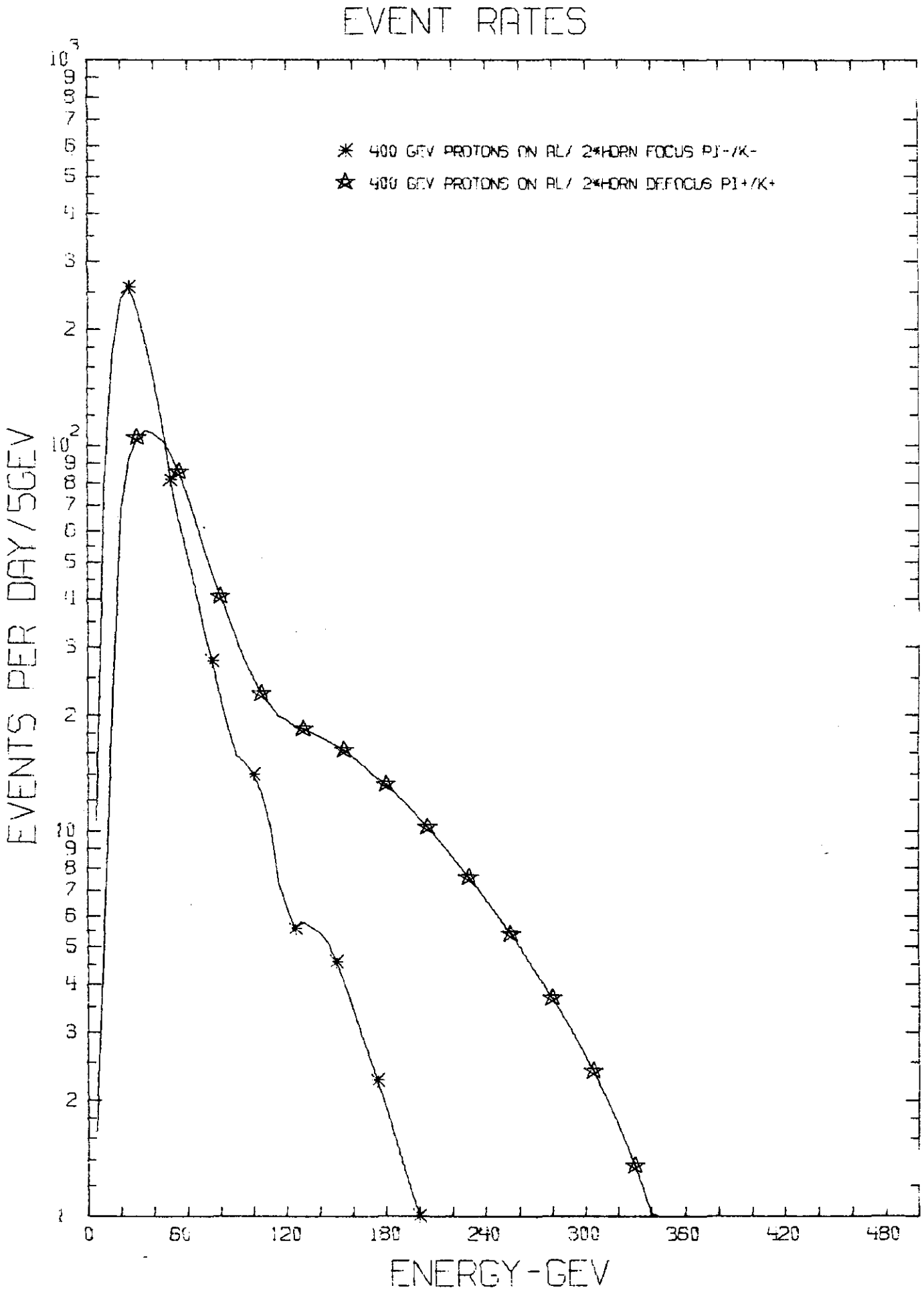
"2*HORN"	:	Double Horns
"HORN"	:	Single Horn Number 1
"HORN#2"	:	Single Horn Number 2
"2ØØ GEV FOCUS... STANDARD TUNE"	:	Quadrupole Triplet Train
"BARE TARGET"	:	No Focussing System
"SIGN-SELECTED FOCUS... 2 CELLS"	:	Sign-Selected Quadrupole Triplet

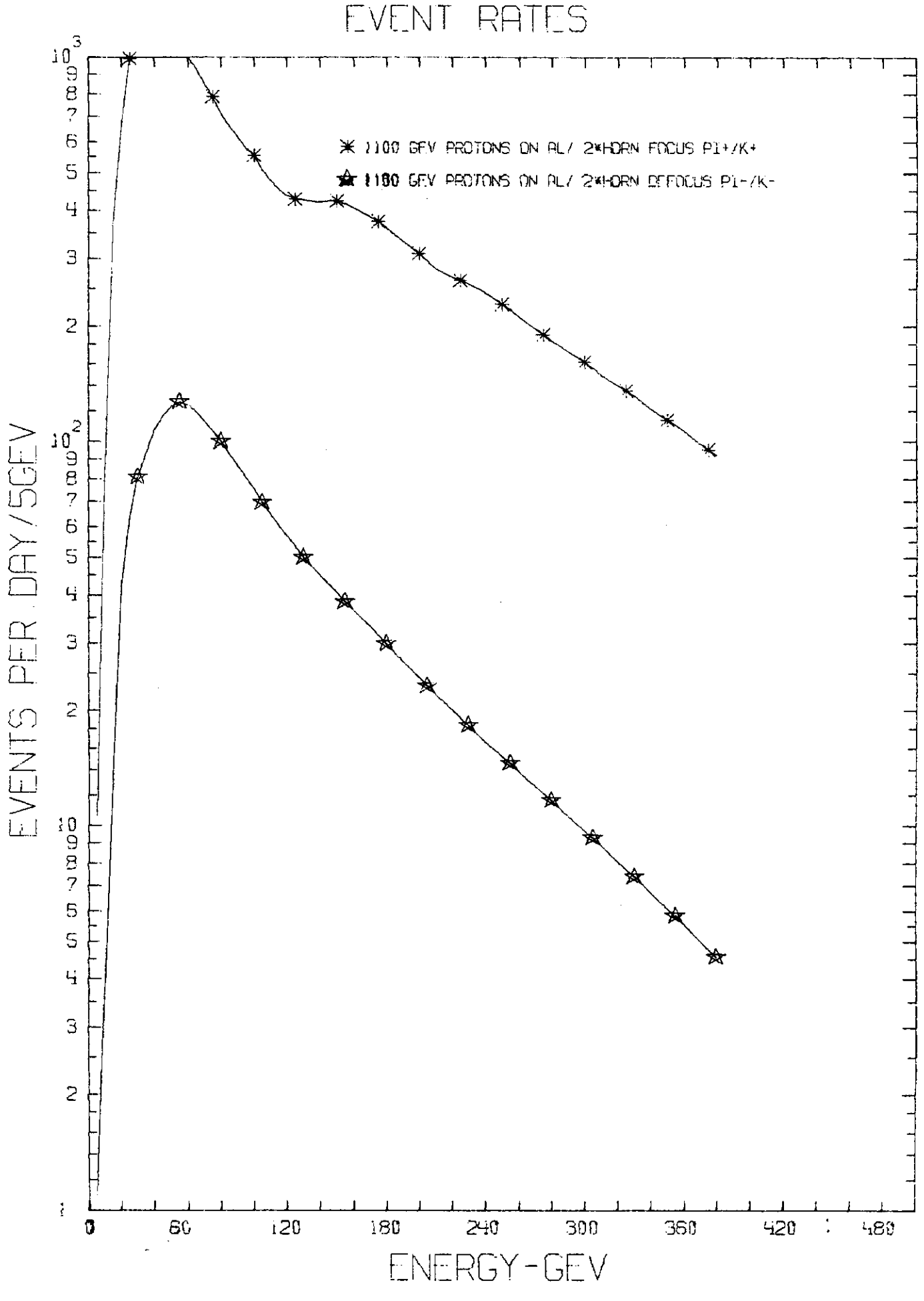
Numbers for all cases of tabulated data are available from the Neutrino Department.

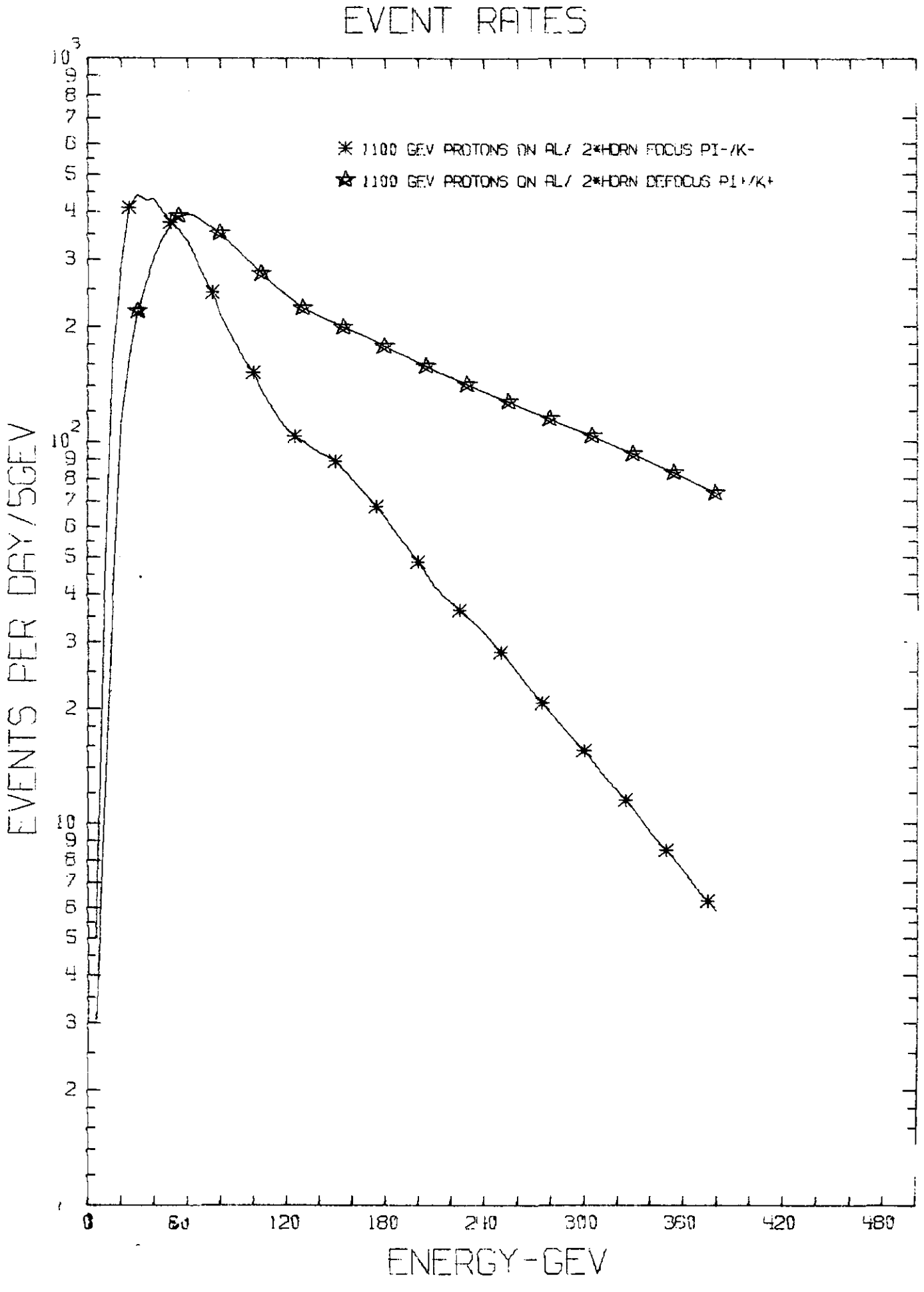

EVENT RATES
* 400 GEV PROTONS ON AL/ 2*HORN FOCUS PI-/K- WITH PLUGS
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

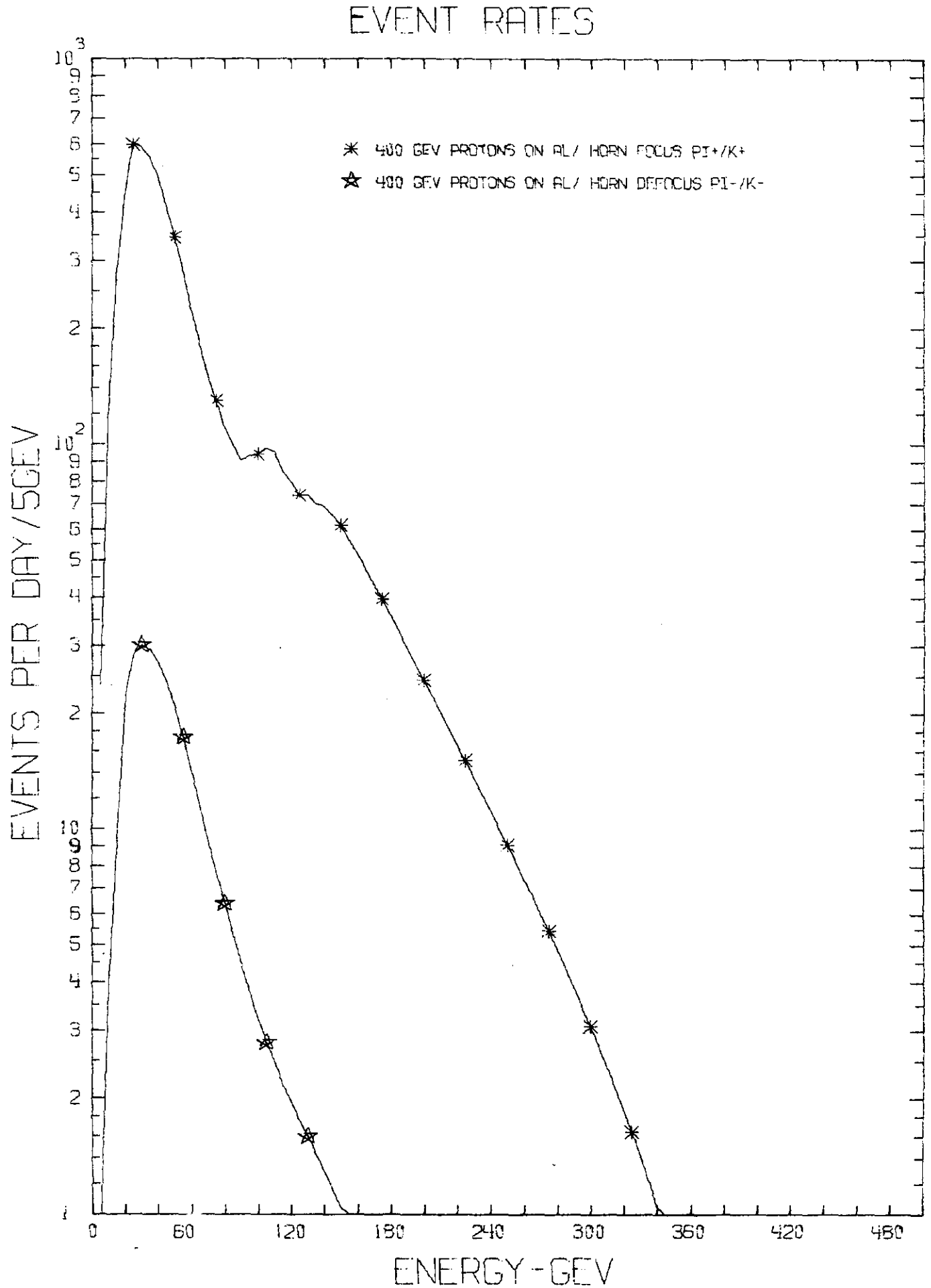

EVENT RATES
* 1100 GEV PROTONS ON AL/ 2*HORN FOCUS PI-/K- WITH PLUGS
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480
1
2
3
4
5
6
7
8
9
10
10^2
10^3

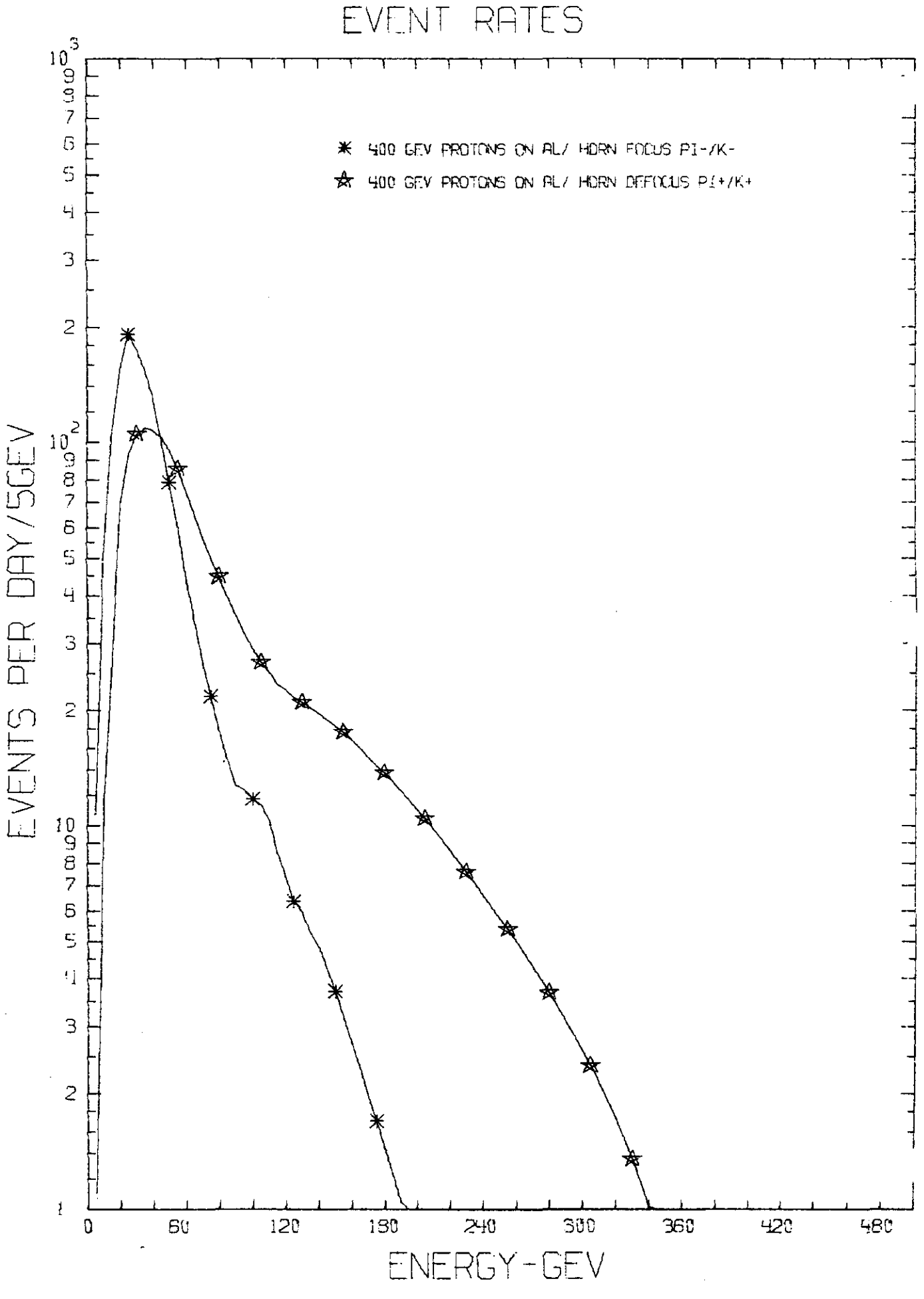

EVENT RATES
400 GEV PROTONS ON AL/ 2*HORN FOCUS PI+/K+
400 GEV PROTONS ON AL/ 2*HORN DEFOCUS PI-/K-
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

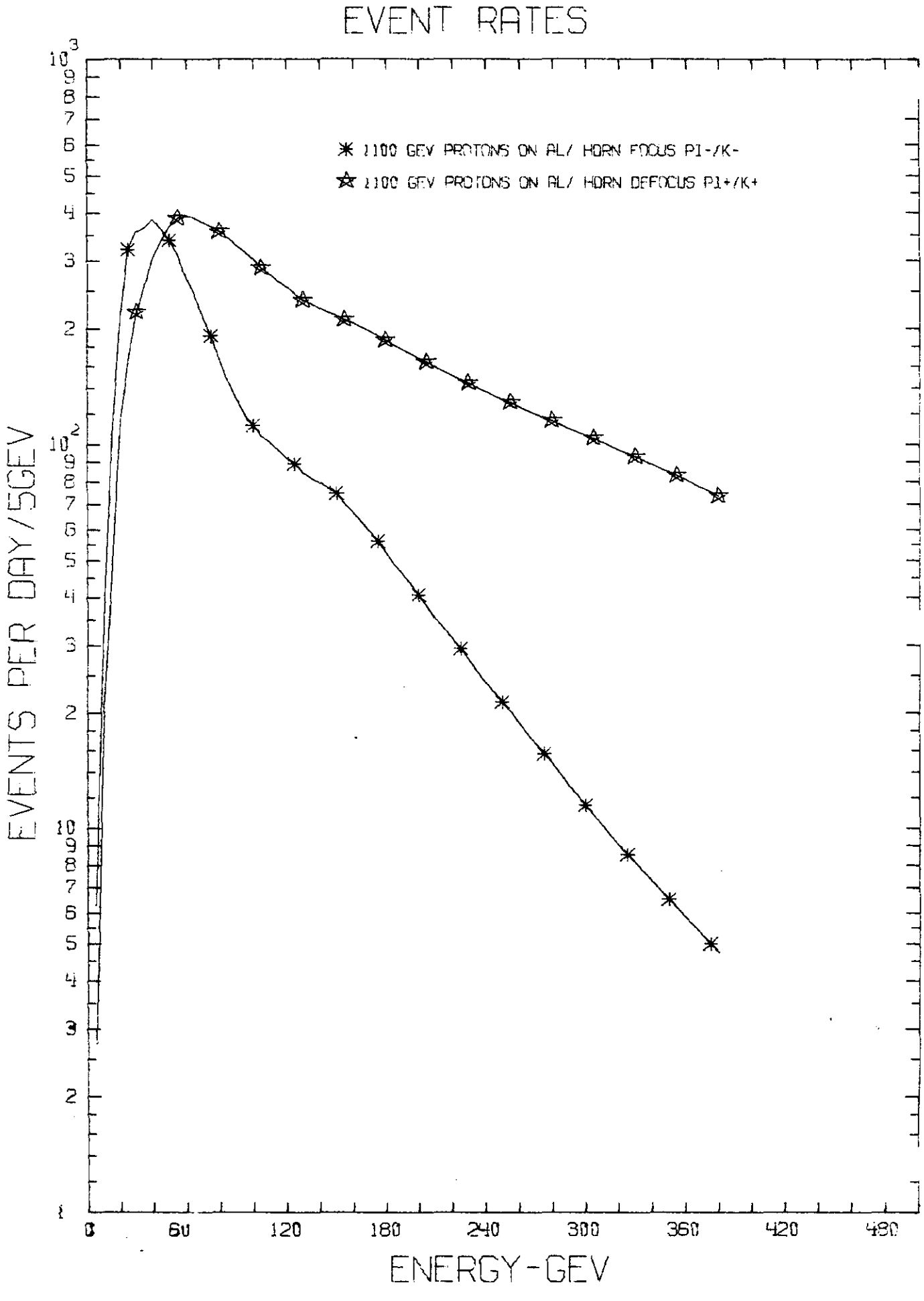

EVENT RATES
400 GEV PROTONS ON AL/ 2*HORN FOCUS PI-/K-
400 GEV PROTONS ON AL/ 2*HORN DEFOCUS PI+/K+
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

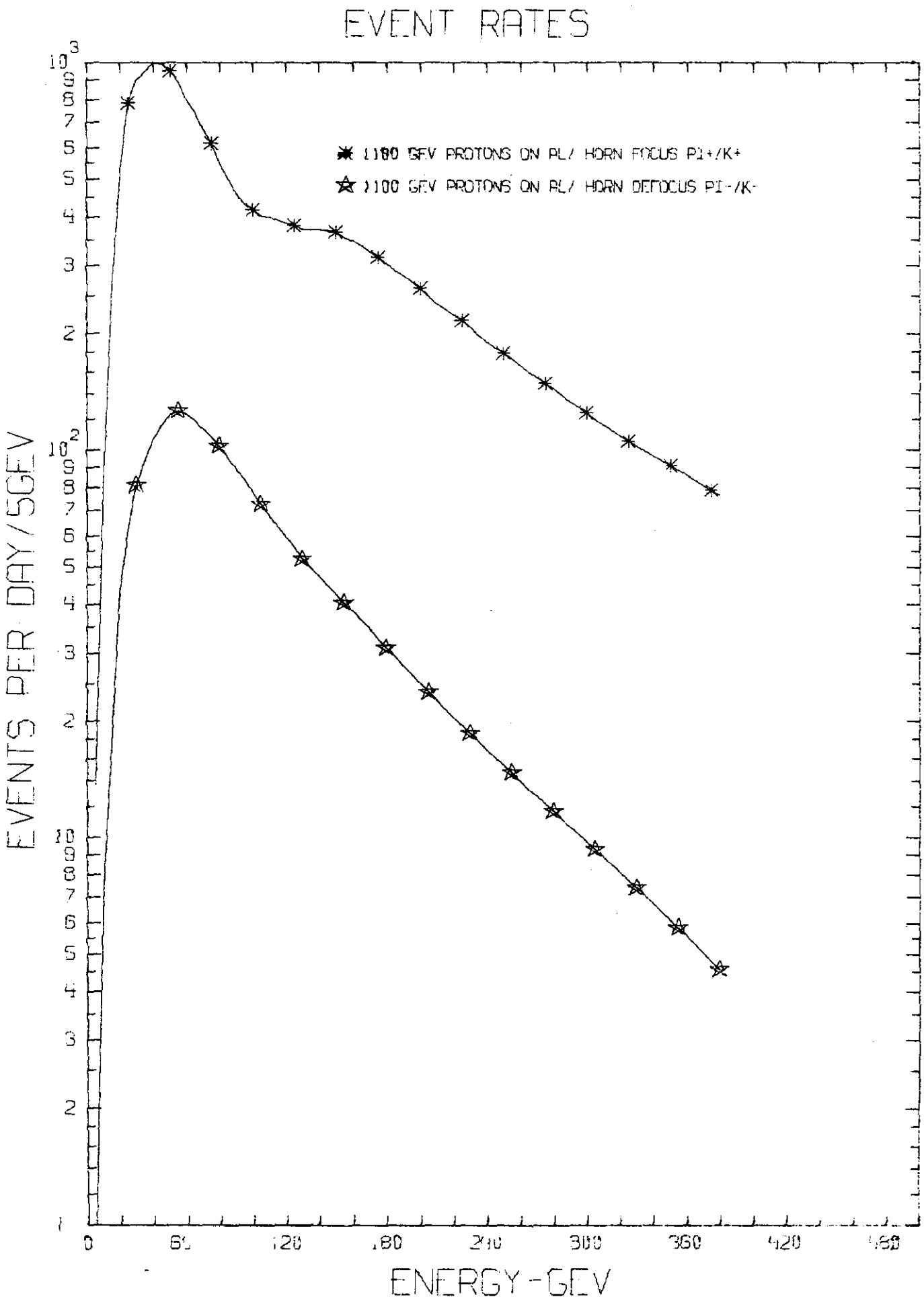

EVENT RATES
1100 GEV PROTONS ON AL/ 2*HORN FOCUS PI+/K+
1100 GEV PROTONS ON AL/ 2*HORN DEFOCUS PI-/K-
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

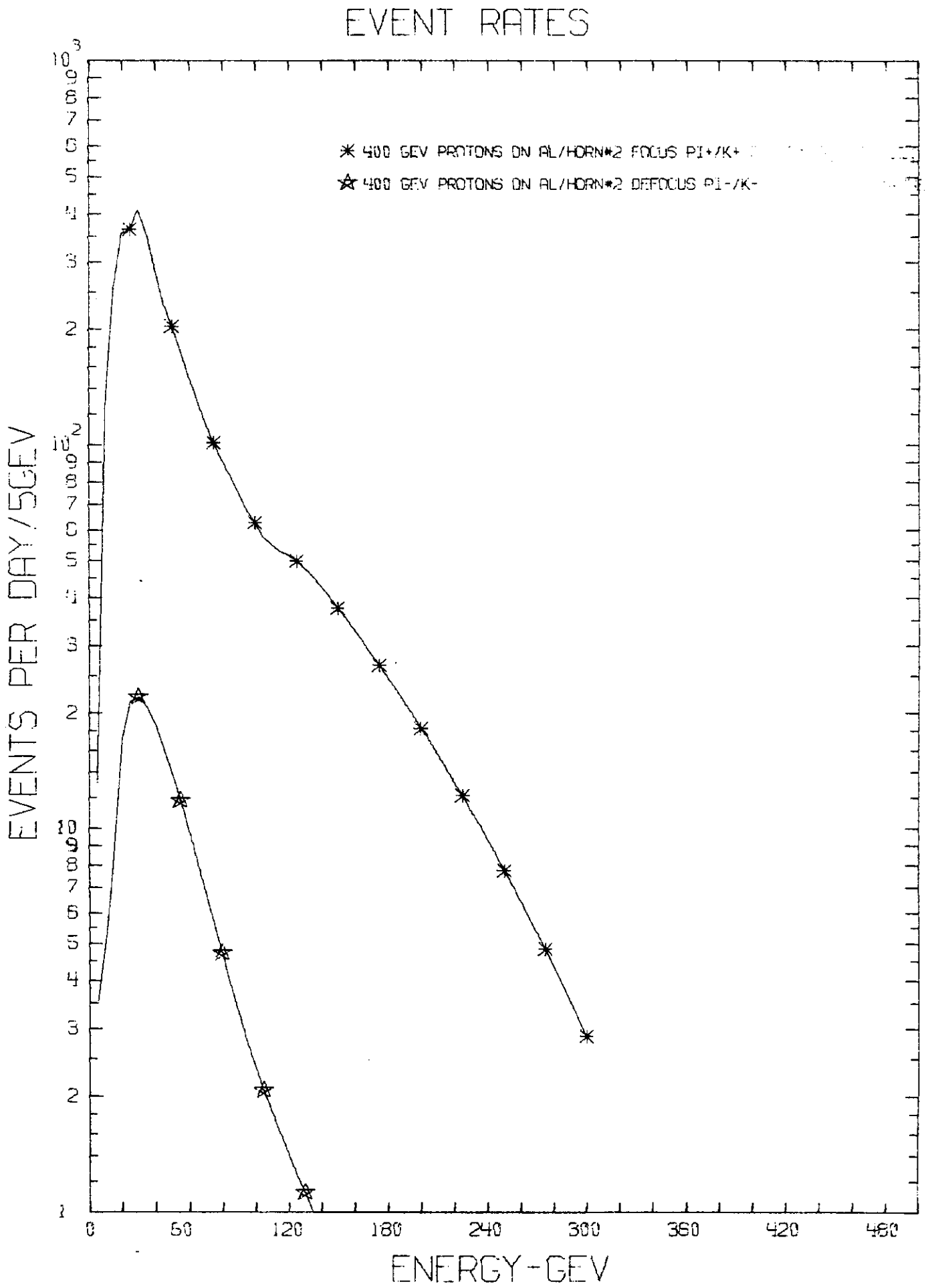

EVENT RATES
1100 GEV PROTONS ON AL/ 2*HORN FOCUS PI-/K-
1100 GEV PROTONS ON AL/ 2*HORN DEFOCUS PI+/K+
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

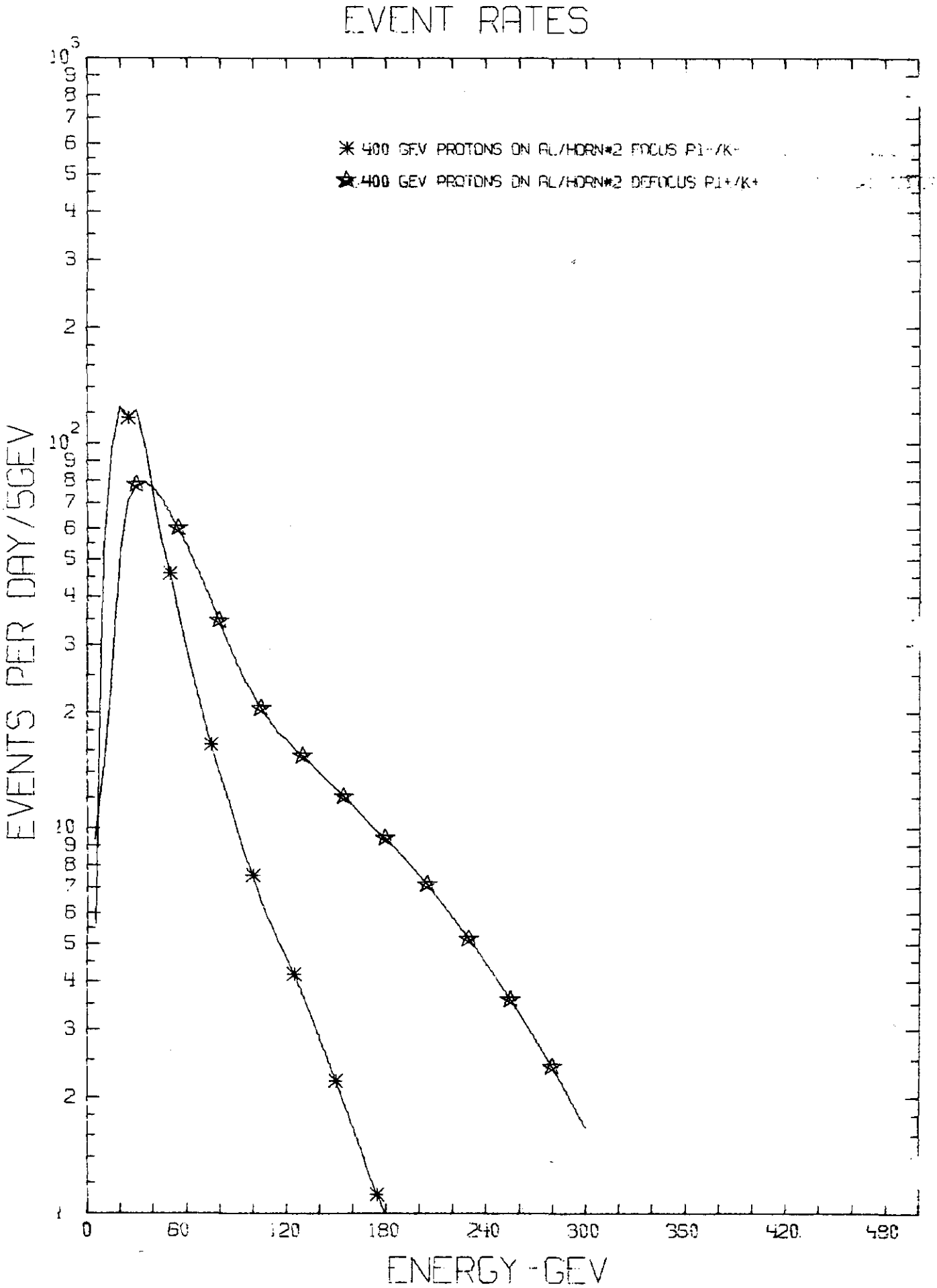

EVENT RATES
400 GEV PROTONS ON AL/ HORN FOCUS PI+/K+
400 GEV PROTONS ON AL/ HORN DEFOCUS PI-/K-
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

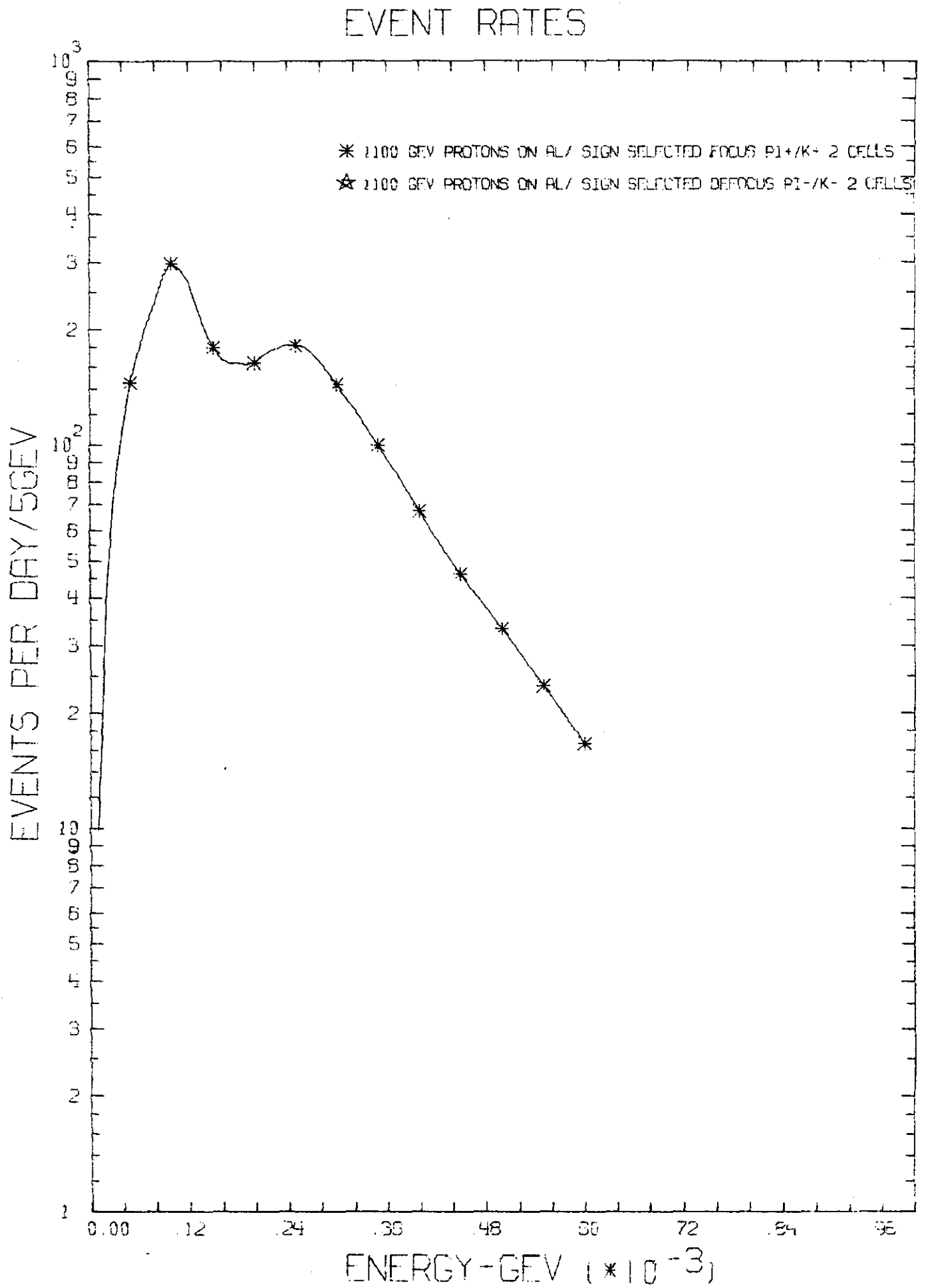

EVENT RATES
400 GEV PROTONS ON AL/ HORN FOCUS PI-/K-
400 GEV PROTONS ON AL/ HORN DEFOCUS PI+/K+
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

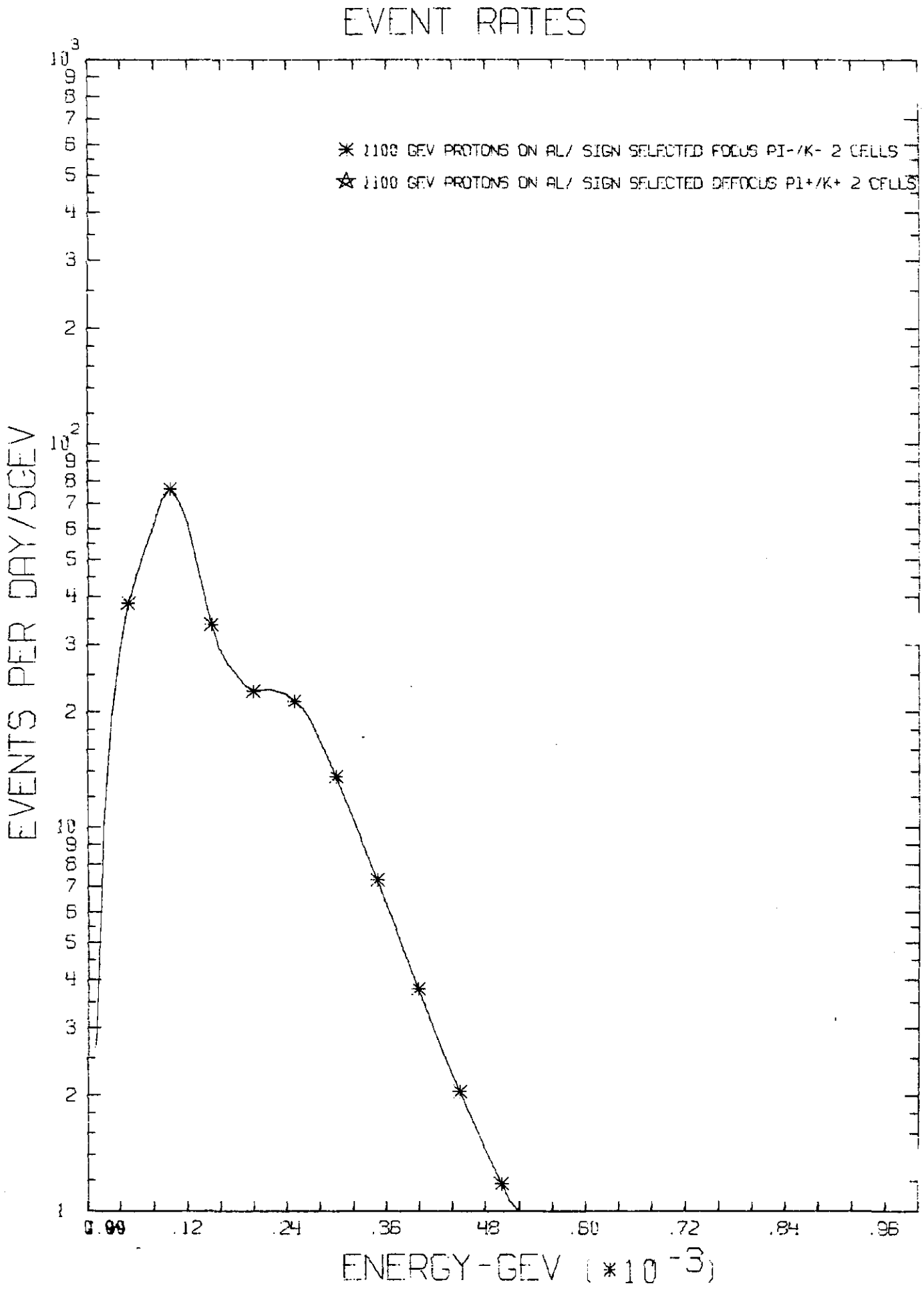

EVENT RATES
✳ 1100 GEV PROTONS ON AL/ HORN FOCUS PI-/K-
☆ 1100 GEV PROTONS ON AL/ HORN DEFOCUS PI+/K+
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

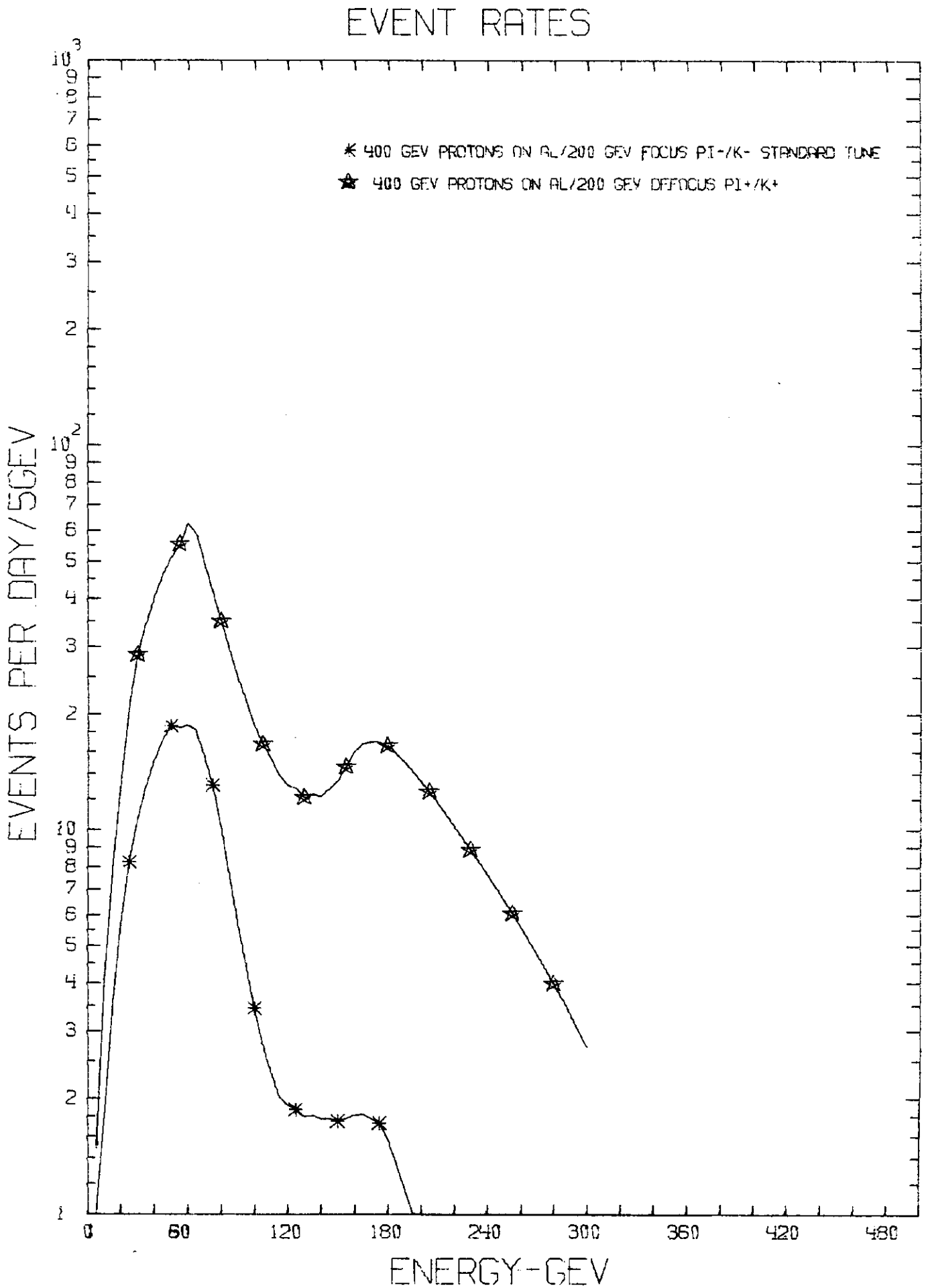

EVENT RATES
1180 GEV PROTONS ON BL/ HORN FOCUS PI+/K+
1100 GEV PROTONS ON BL/ HORN DEFOCUS PI-/K-
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

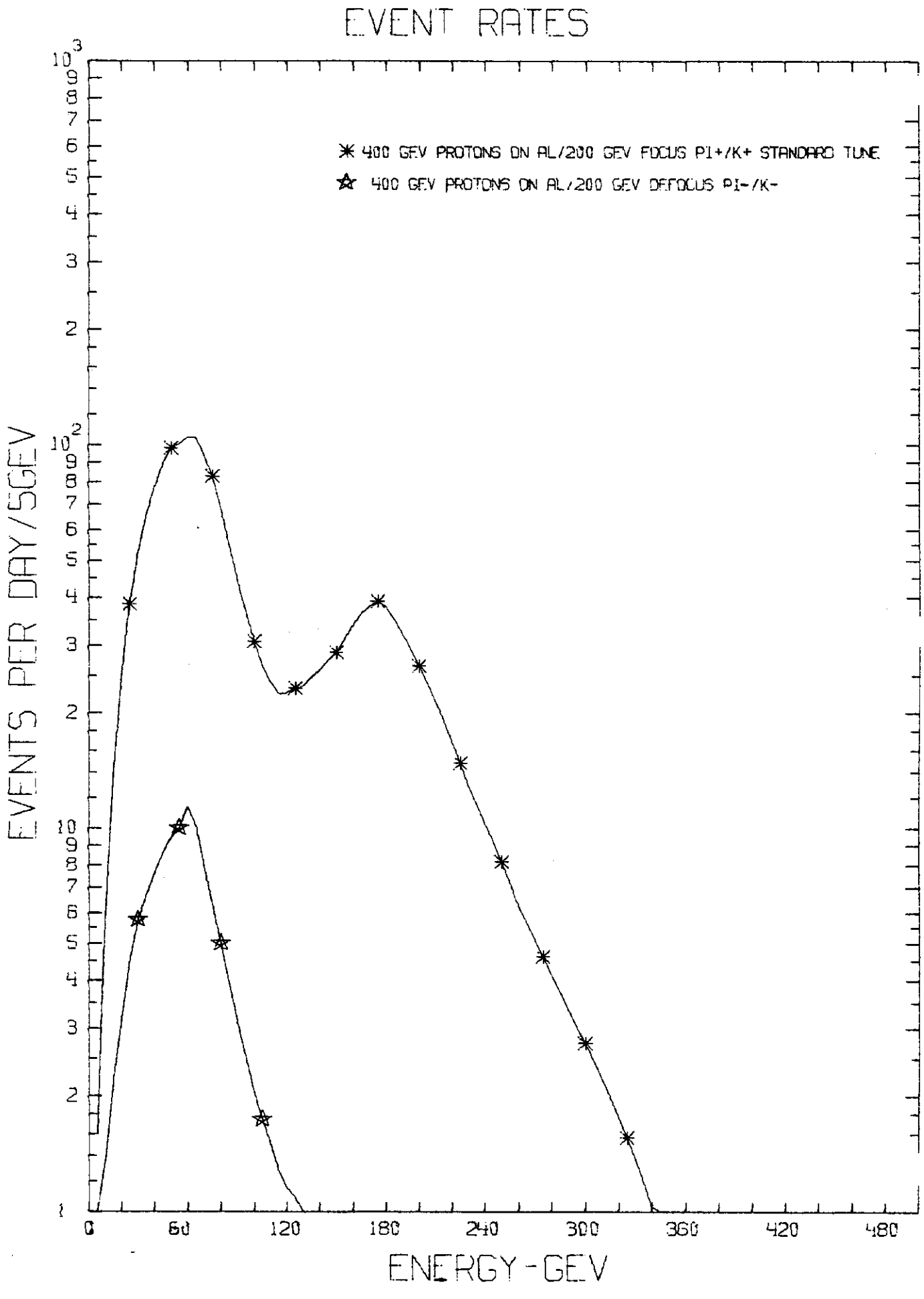

EVENT RATES
400 GEV PROTONS ON AL/HORN*2 FOCUS PI+/K+
400 GEV PROTONS ON AL/HORN*2 DEFOCUS PI-/K-
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

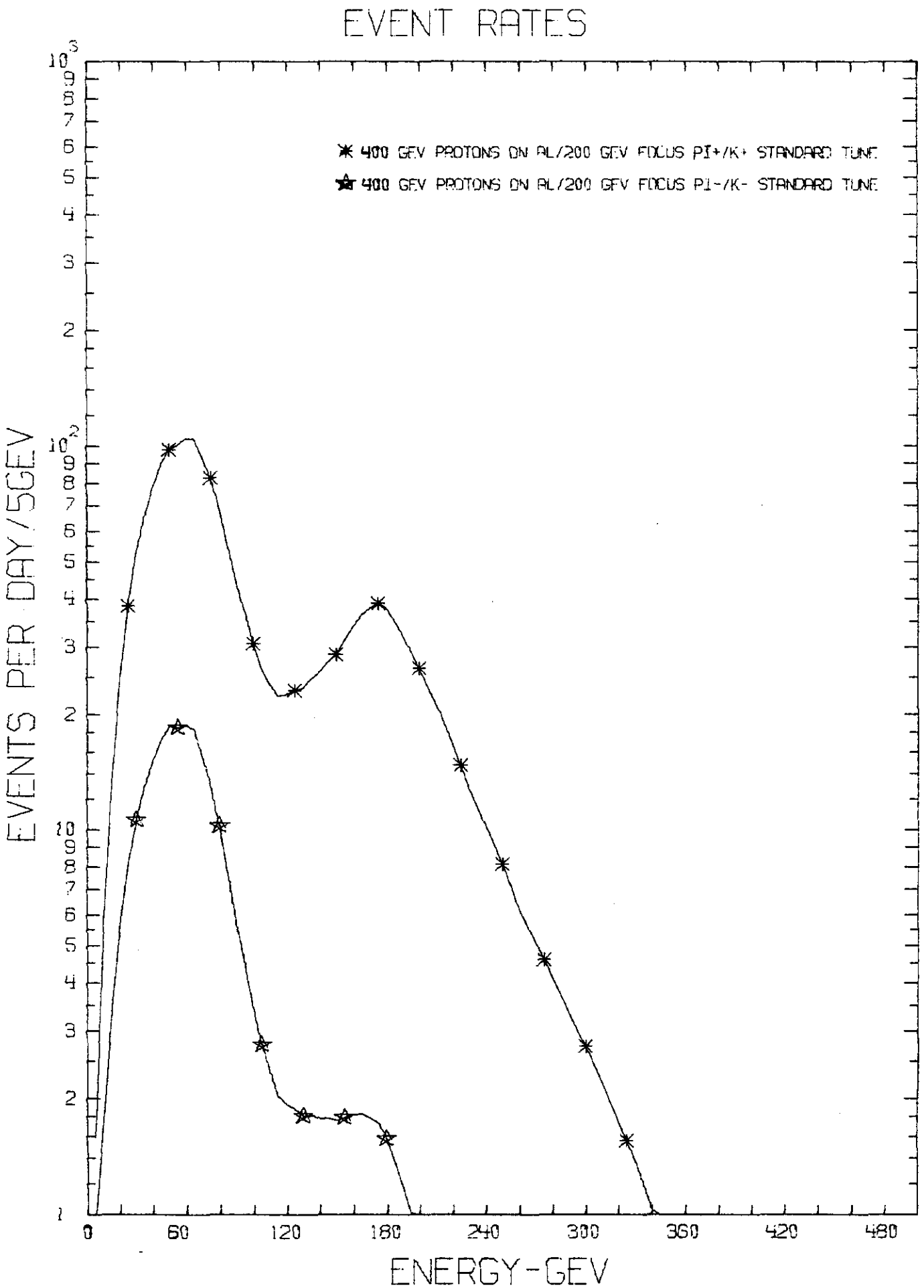

EVENT RATES
400 GEV PROTONS ON AL/HORN#2 FOCUS PI-/K-
400 GEV PROTONS ON AL/HORN#2 DEFOCUS PI+/K+
EVENTS PER DAY/5GEV
ENERGY - GEV
0
60
120
180
240
300
360
420
480

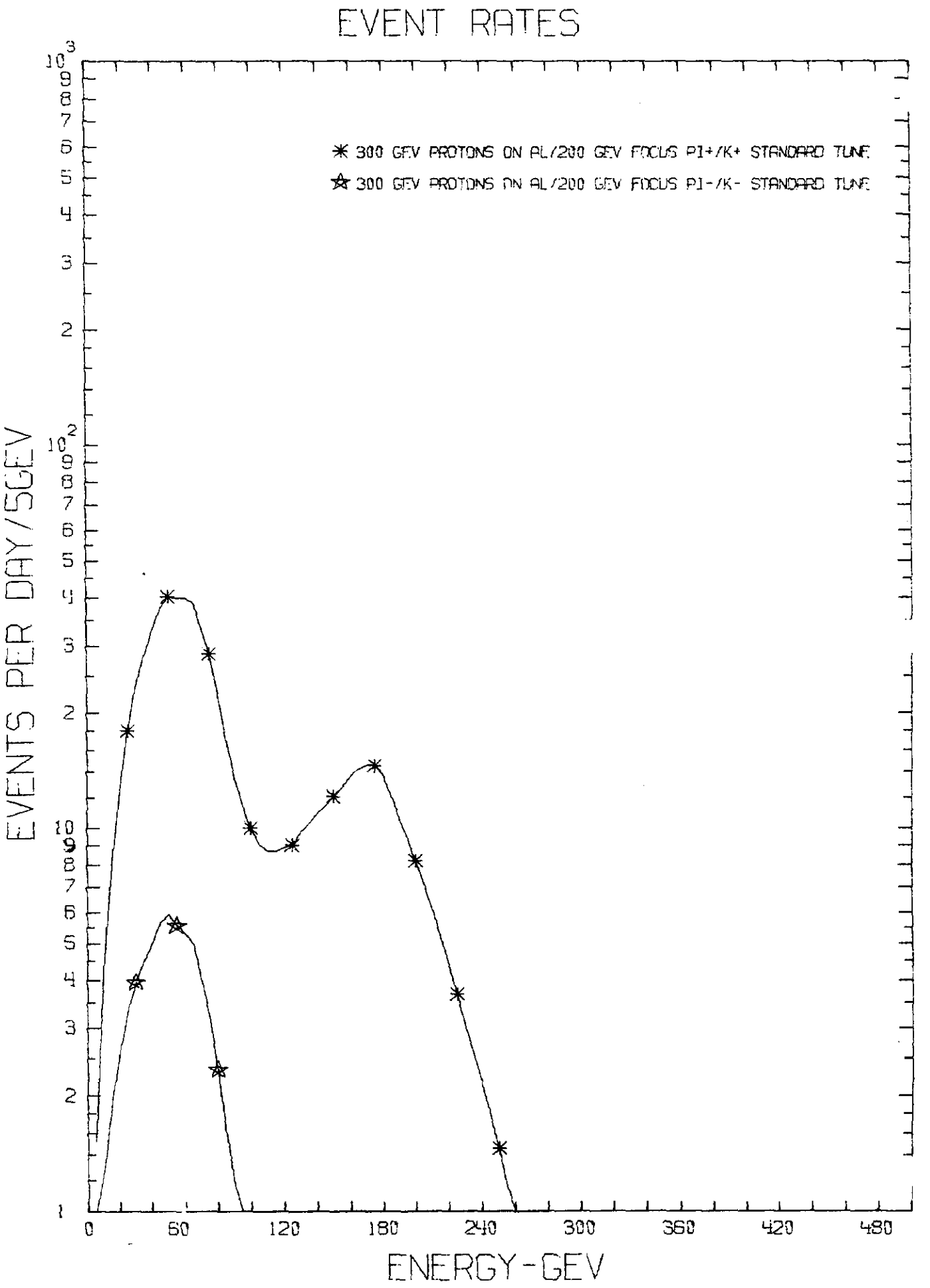

EVENT RATES
✳ 1100 GEV PROTONS ON AL/ SIGN SELECTED FOCUS PI+/K+ 2 CELLS
☆ 1100 GEV PROTONS ON AL/ SIGN SELECTED DEFOCUS PI-/K- 2 CELLS
EVENTS PER DAY/5GEV
ENERGY-GEV (*10^-3)
0.00
.12
.24
.36
.48
.60
.72
.84
.96

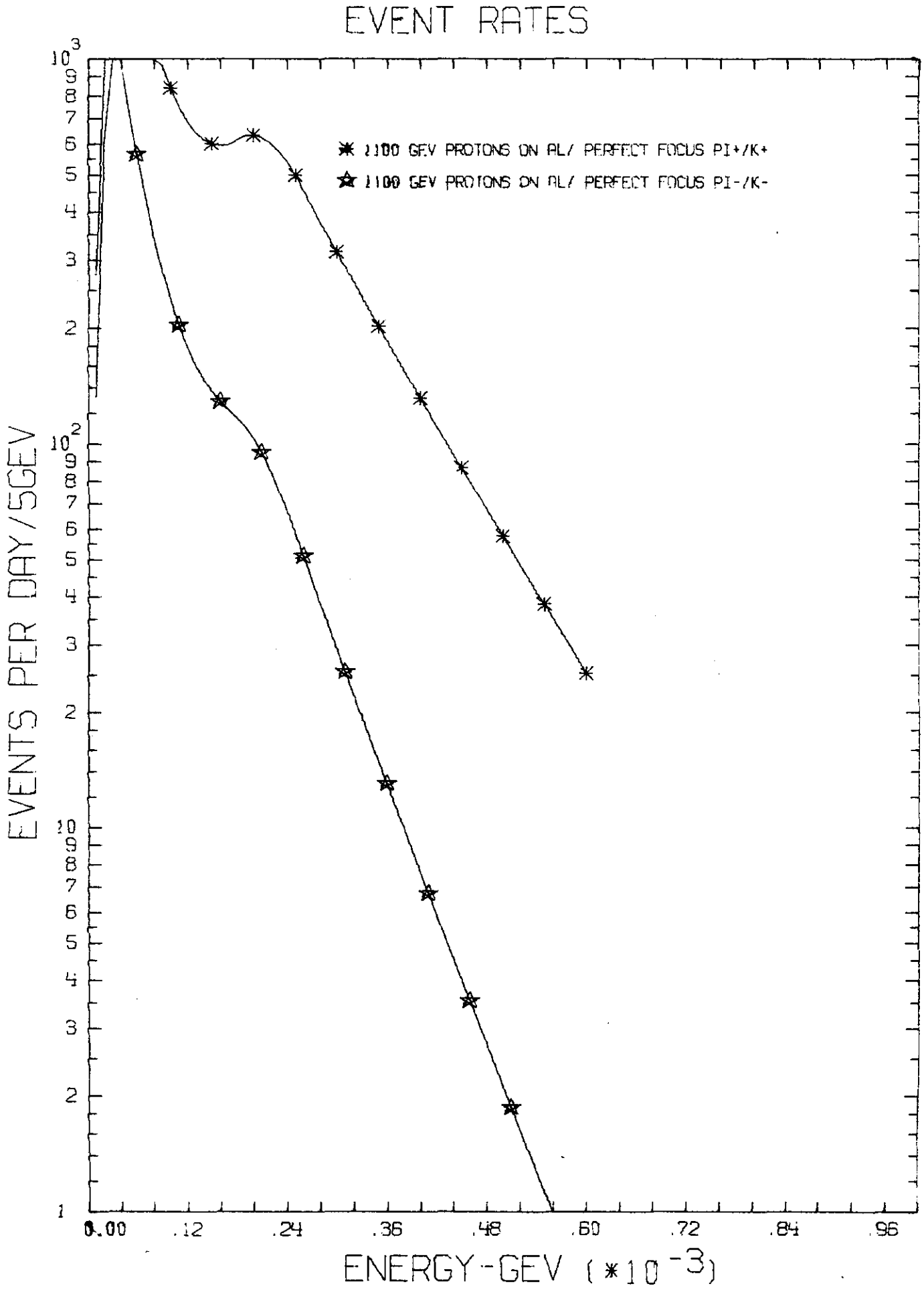

EVENT RATES
✳ 1100 GEV PROTONS ON AL/ SIGN SELECTED FOCUS PI-/K- 2 CELLS
☆ 1100 GEV PROTONS ON AL/ SIGN SELECTED DEFOCUS PI+/K+ 2 CELLS
EVENTS PER DAY/5GEV
ENERGY-GEV (*10^-3)
0.00
.12
.24
.36
.48
.60
.72
.84
.96

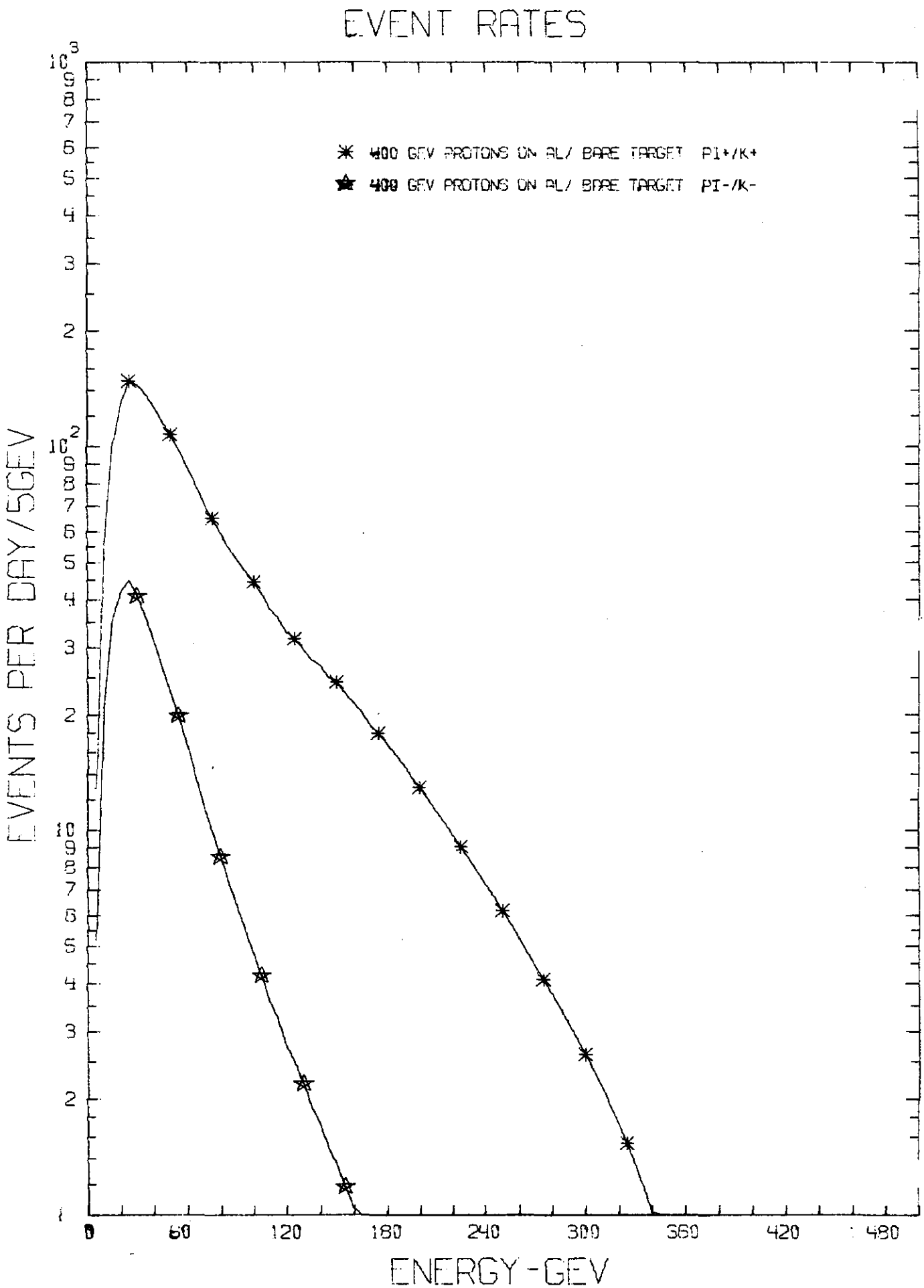

EVENT RATES
* 400 GEV PROTONS ON AL/200 GEV FOCUS PI-/K- STANDARD TUNE
400 GEV PROTONS ON AL/200 GEV DEFOCUS PI+/K+
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

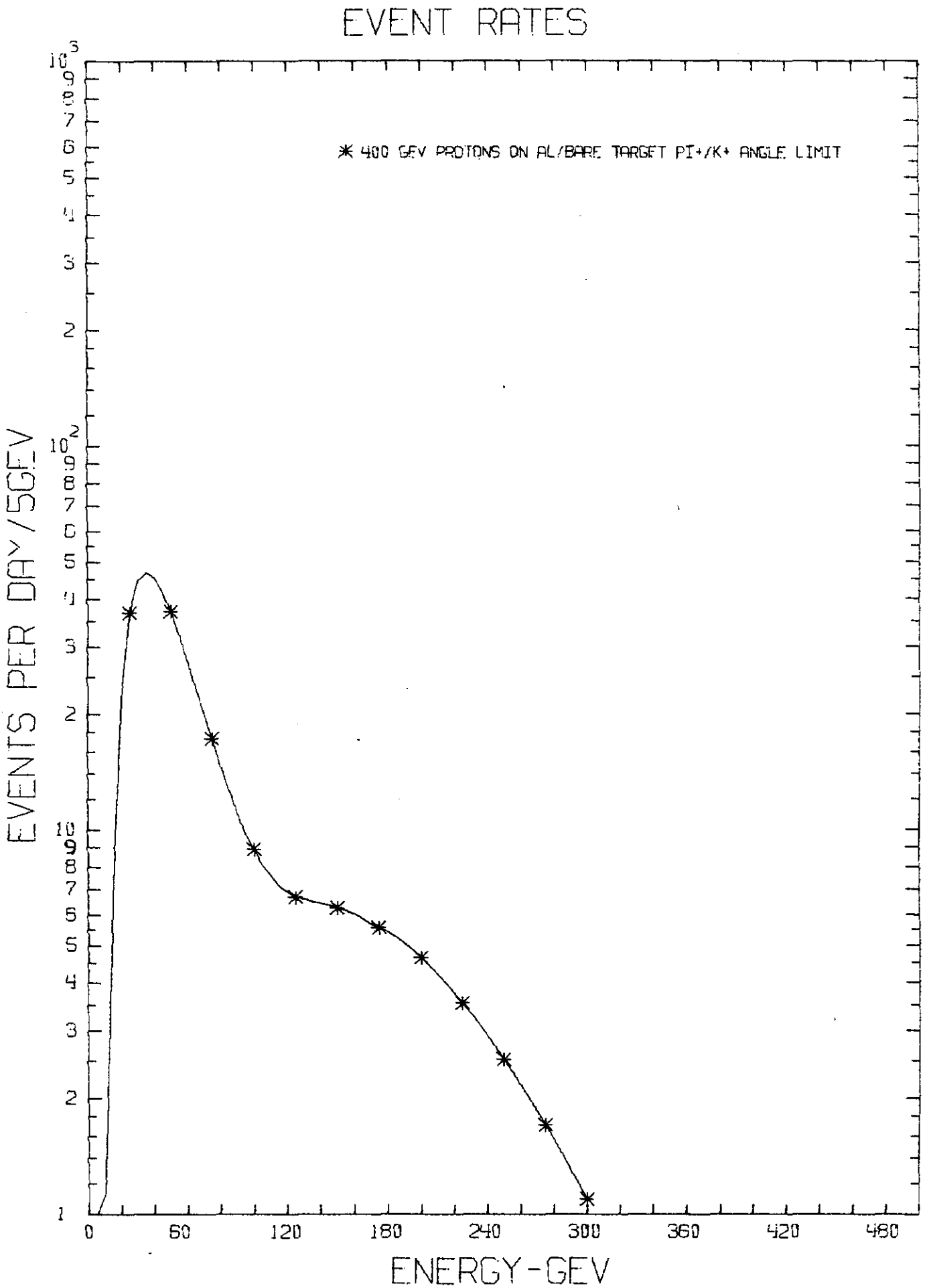

EVENT RATES
400 GEV PROTONS ON AL/200 GEV FOCUS PI+/K+ STANDARD TUNE
400 GEV PROTONS ON AL/200 GEV DEFOCUS PI-/K-
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

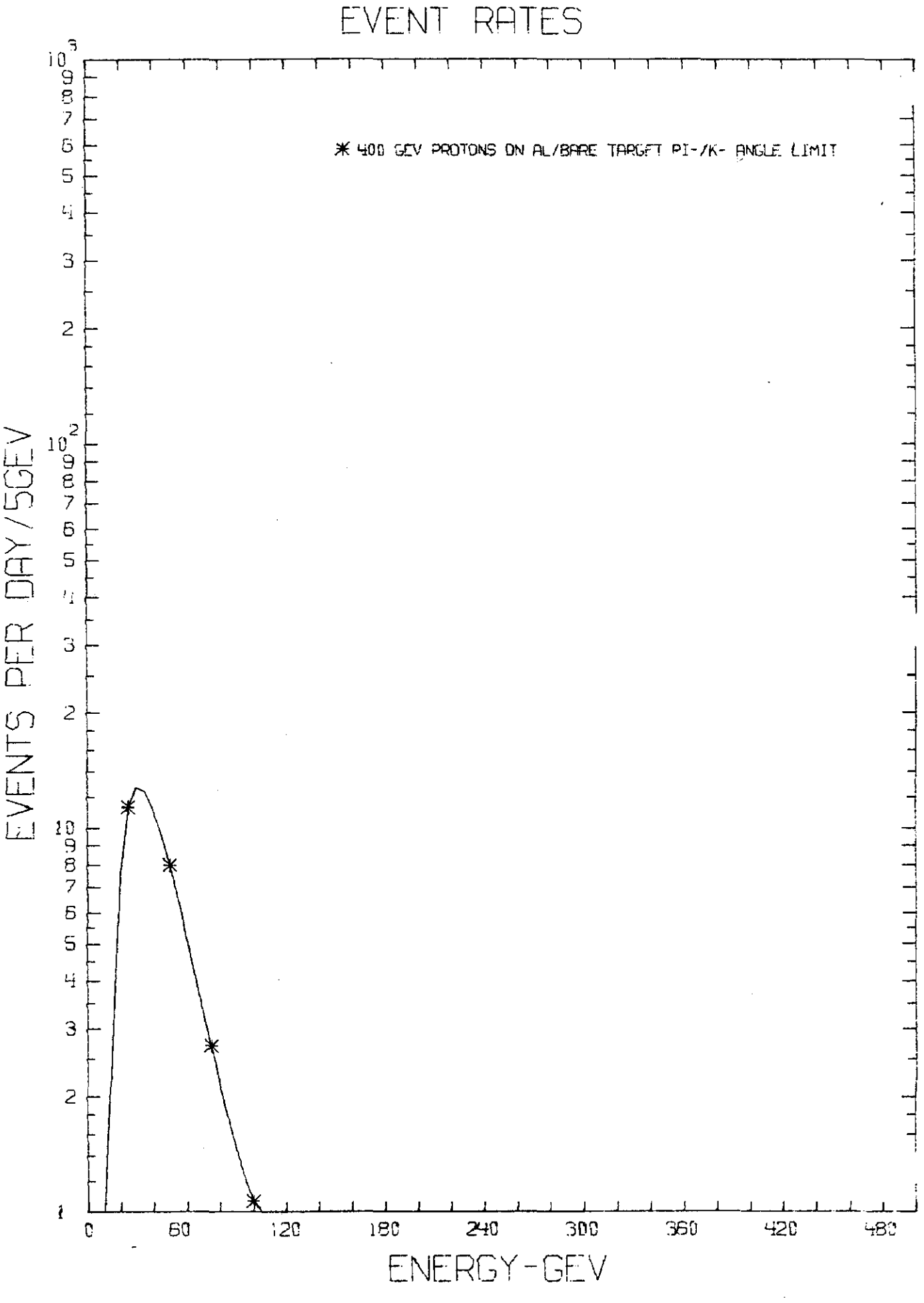

EVENT RATES
400 GEV PROTONS ON AL/200 GEV FOCUS PI+/K+ STANDARD TUNE
400 GEV PROTONS ON AL/200 GEV FOCUS PI-/K- STANDARD TUNE
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

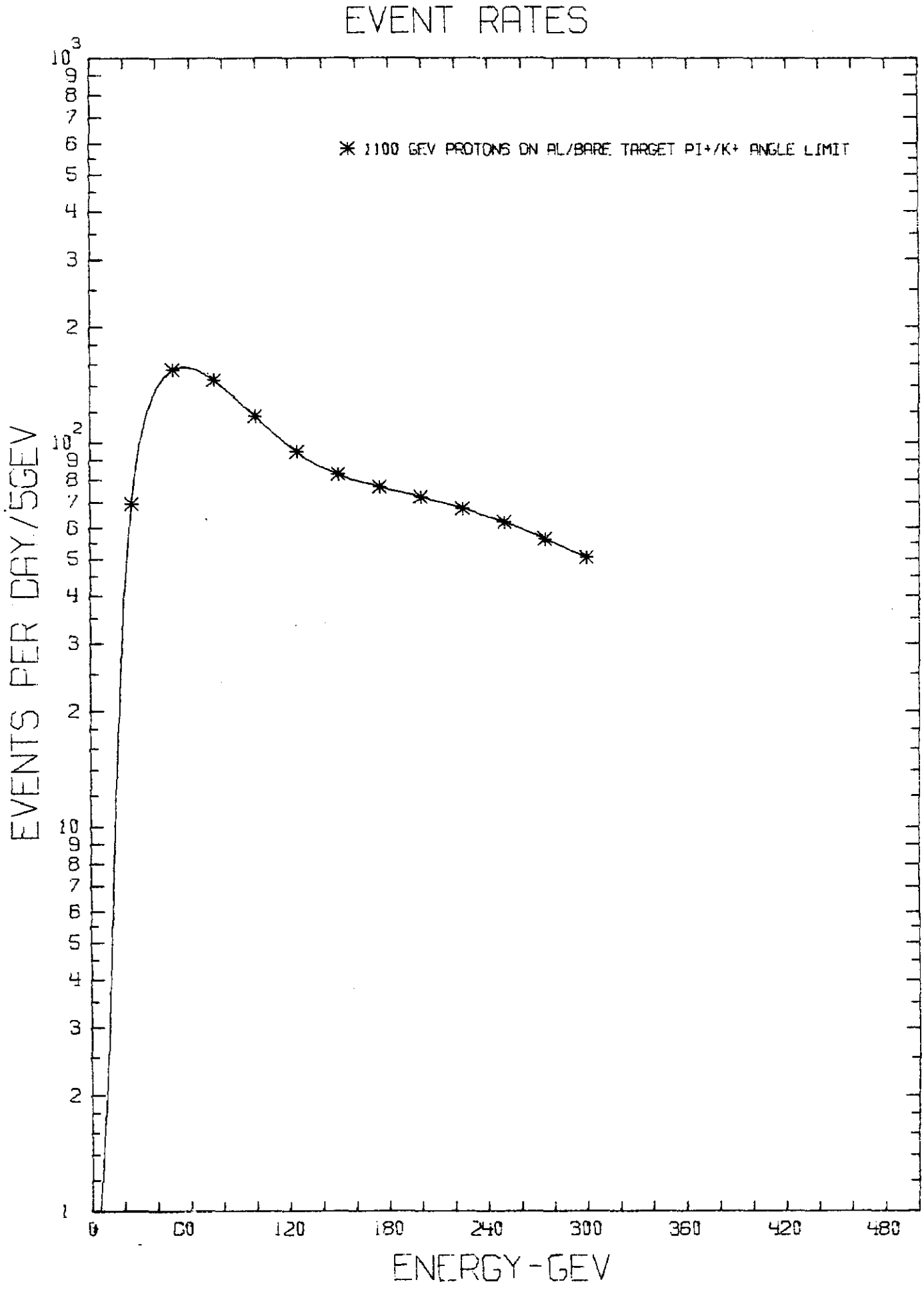

EVENT RATES
300 GEV PROTONS ON AL/200 GEV FOCUS PI+/K+ STANDARD TUNE
300 GEV PROTONS ON AL/200 GEV FOCUS PI-/K- STANDARD TUNE
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

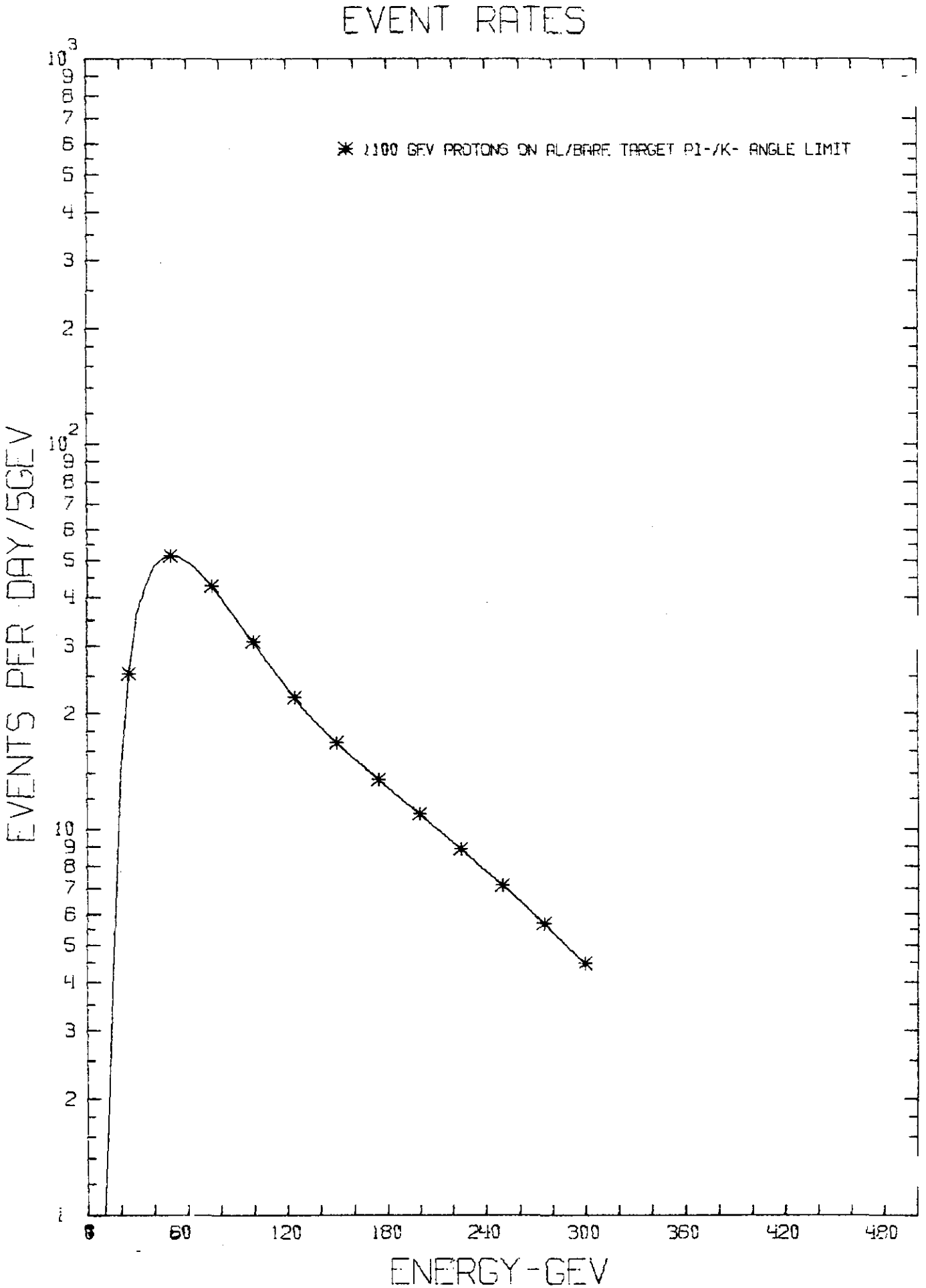

EVENT RATES
1100 GEV PROTONS ON AL/ PERFECT FOCUS PI+/K+
1100 GEV PROTONS ON AL/ PERFECT FOCUS PI-/K-
EVENTS PER DAY/5GEV
ENERGY-GEV (*10^-3)
0.00
.12
.24
.36
.48
.60
.72
.84
.96

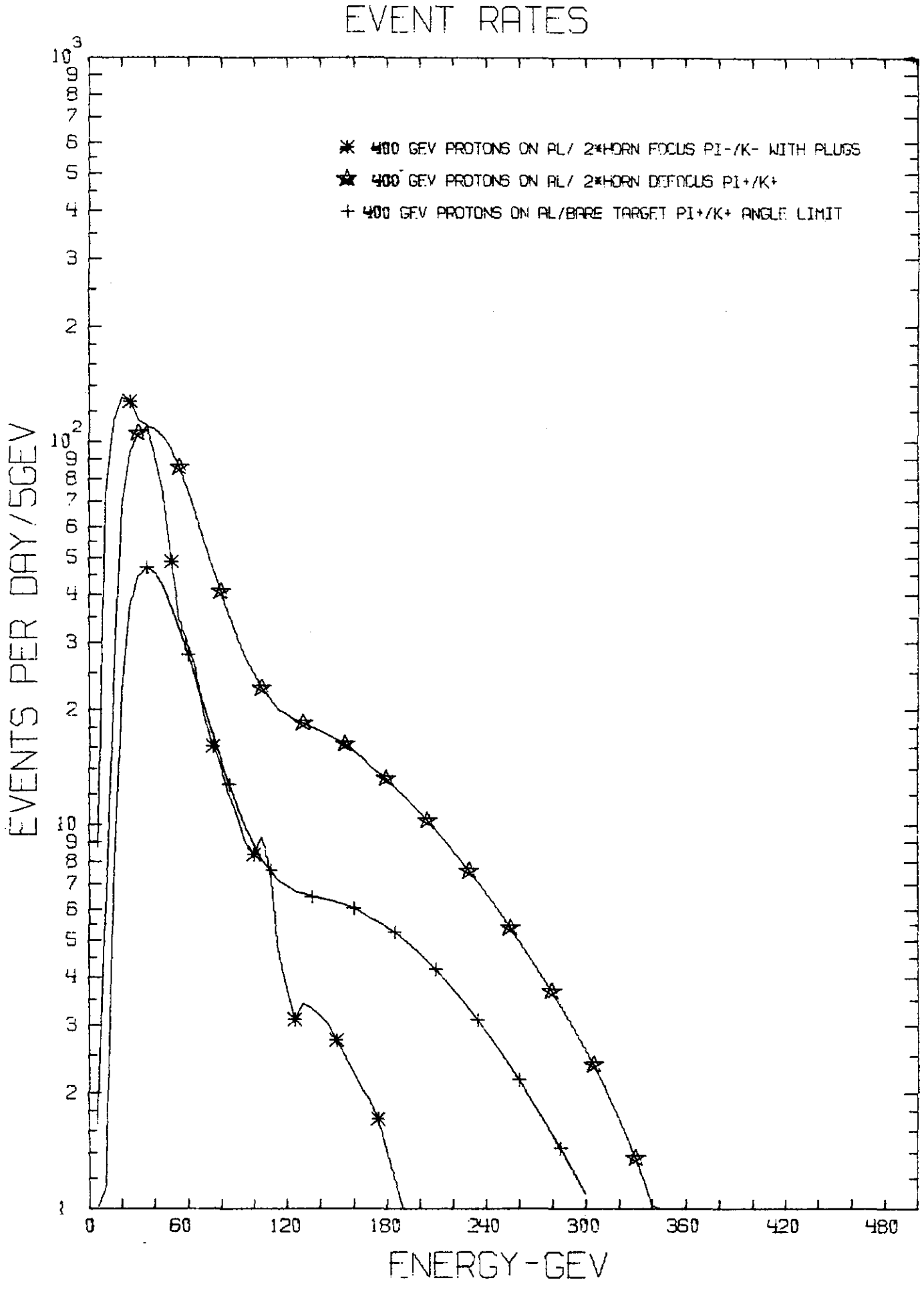

EVENT RATES
400 GEV PROTONS ON AL/ BARE TARGET PI+/K+
400 GEV PROTONS ON AL/ BARE TARGET PI-/K-
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

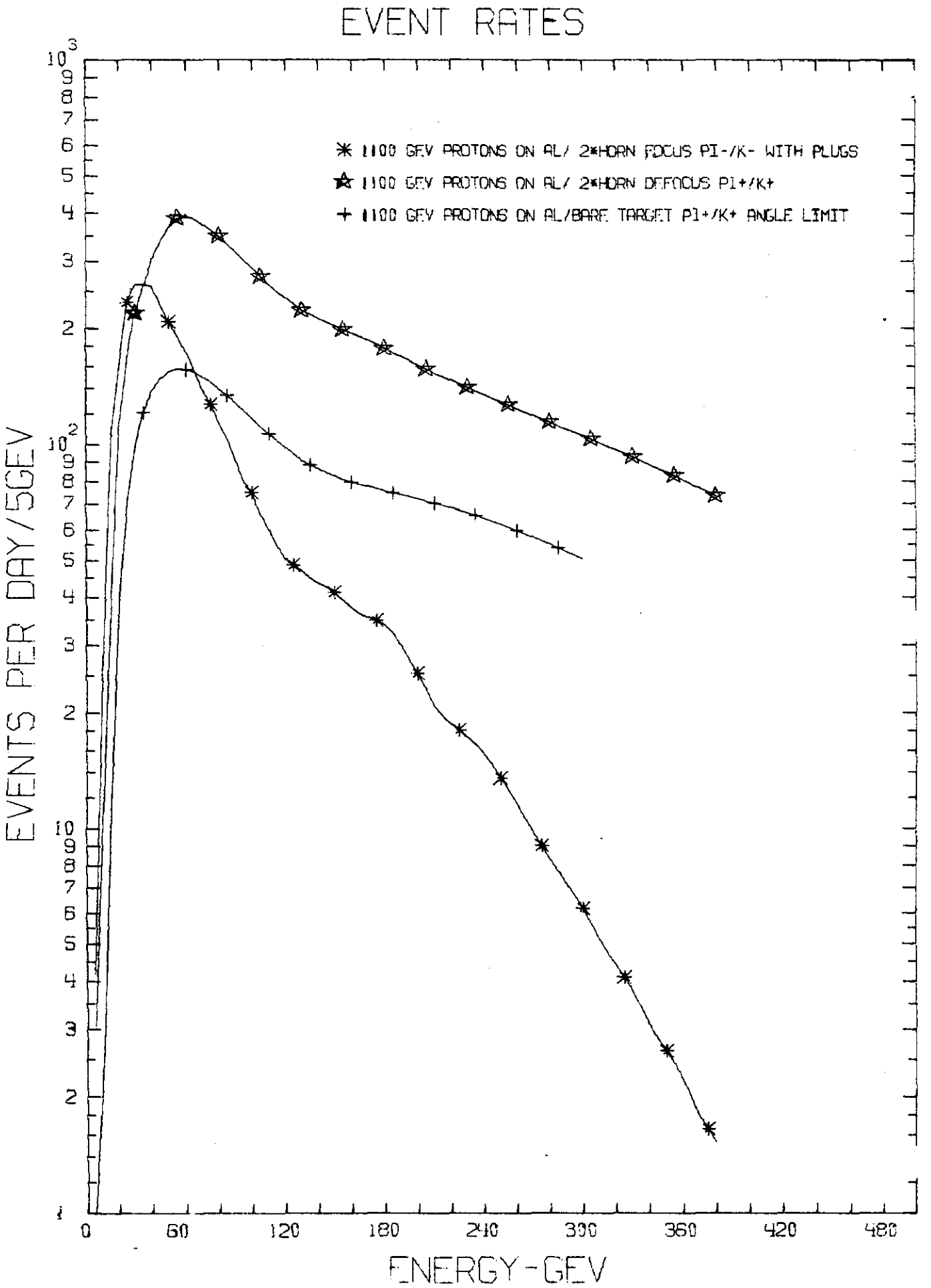

EVENT RATES
* 400 GEV PROTONS ON AL/BARE TARGET PI+/K+ ANGLE LIMIT
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

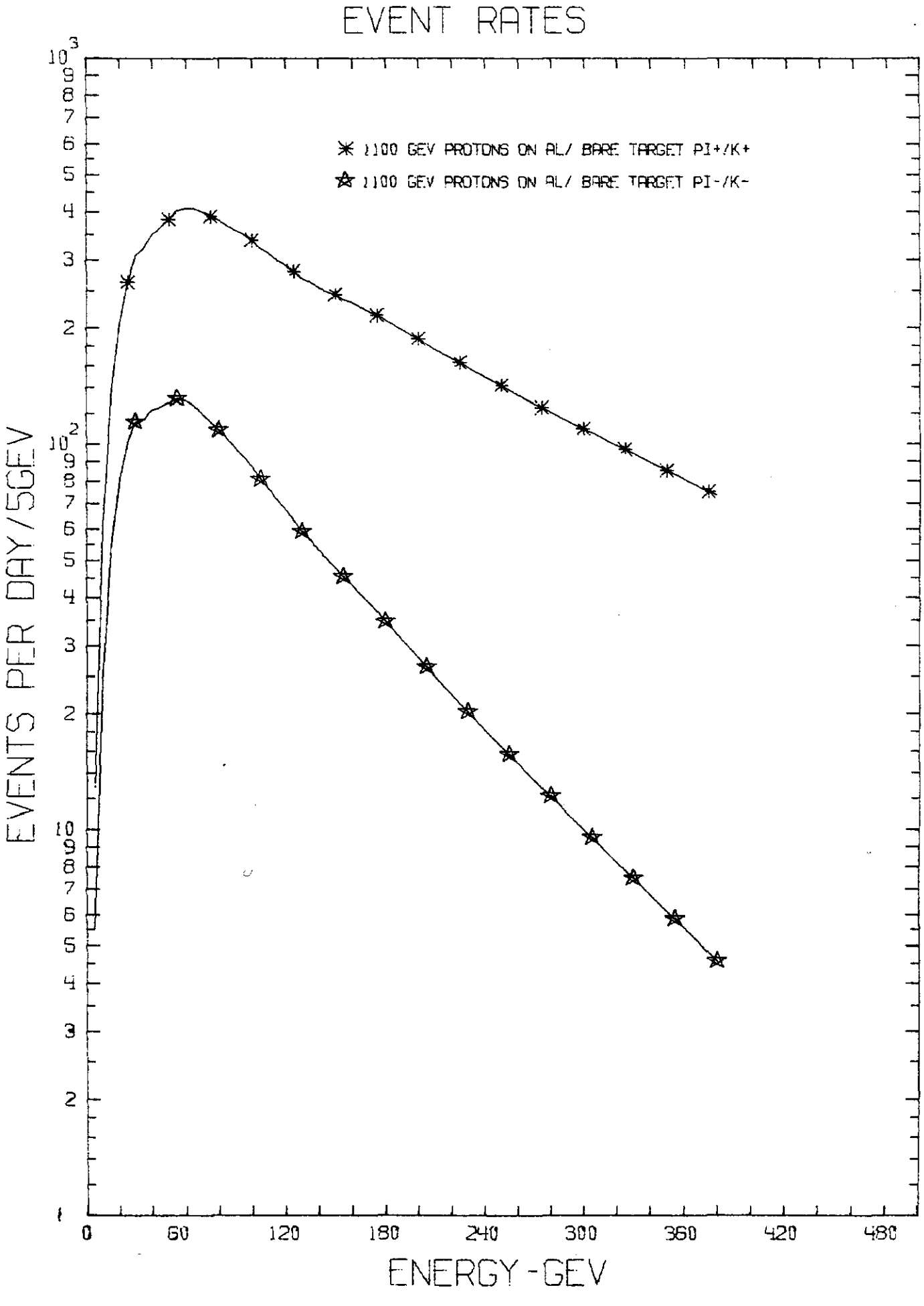

EVENT RATES
* 400 GEV PROTONS ON AL/BARE TARGET PI-/K- ANGLE LIMIT
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480

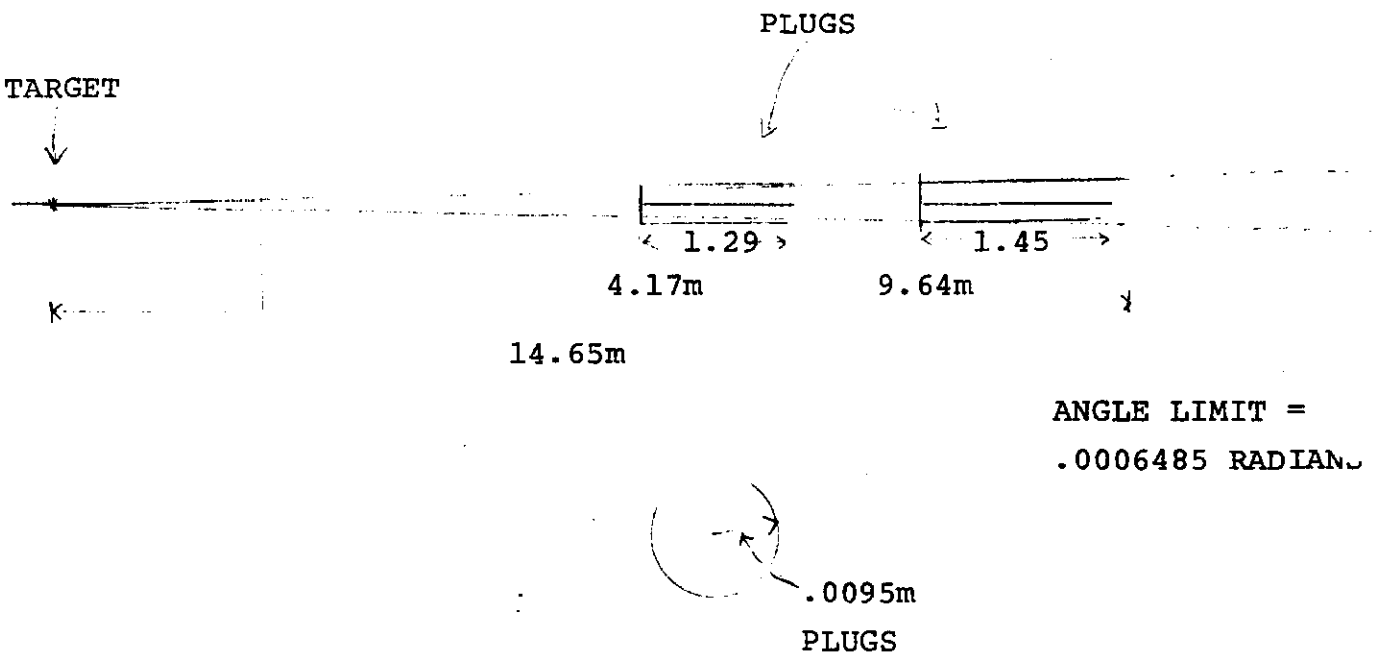

EVENT RATES
* 1100 GEV PROTONS ON AL/BARE TARGET PI+/K+ ANGLE LIMIT
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480


EVENT RATES
* 2100 GEV PROTONS ON AL/BARE TARGET PI-/K- ANGLE LIMIT
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480


EVENT RATES
400 GEV PROTONS ON AL/ 2*HORN FOCUS PI-/K- WITH PLUGS
400 GEV PROTONS ON AL/ 2*HORN DEFOCUS PI+/K+
400 GEV PROTONS ON AL/BARE TARGET PI+/K+ ANGLE LIMIT
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480


EVENT RATES
1100 GEV PROTONS ON AL/ 2*HORN FOCUS PI-/K- WITH PLUGS
1100 GEV PROTONS ON AL/ 2*HORN DEFOCUS PI+/K+
1100 GEV PROTONS ON AL/BARE TARGET PI+/K+ ANGLE LIMIT
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480


EVENT RATES
1100 GEV PROTONS ON AL/ BARE TARGET PI+/K+
1100 GEV PROTONS ON AL/ BARE TARGET PI-/K-
EVENTS PER DAY/5GEV
ENERGY-GEV
0
60
120
180
240
300
360
420
480


PLUGS
TARGET
1.29
1.45
4.17m
9.64m
14.65m
ANGLE LIMIT =
.0006485 RADIANS
.0095m
PLUGS