# **Output of CORSIKA**

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# Input (steering) File

<u>F</u>ile <u>E</u>dit <u>V</u>iew <u>T</u>erminal <u>H</u>elp

/hor

SEEI 0BSI

DEB

EXII

ne/pi	ierog/corsika/corsika-6970/run	: cat all-inputs		
٧R	1	run number		
٧R	1	number of first shower event		
WC	1	number of showers to generate		
PAR	14	particle type of prim. particle		
DPE	-2.7	slope of primary energy spectrum		
NGE	1.E3 1.E3	energy range of primary particle		
ΓAΡ	20. 20.	range of zenith angle (degree)		
>	-180. 180.	range of azimuth angle (degree)		
2	1 0 0	seed for 1. random number sequence		
2	2 0 0	seed for 2. random number sequence		
_EV	110.E2	observation level (in cm)		
CHI	0.	starting altitude (g/cm**2)		
	20.0 42.8	magnetic field centr. Europe		
	0 0 0 0 0 2	flags hadr.interact.&fragmentation		
rs	0.3 0.3 0.003 0.003	energy cuts for particles		
DDI	Т	additional info for muons		
	Т	muon multiple scattering angle		
=LG	тт	em. interaction flags (NKG,EGS)		
	1.0	mult. scattering step length fact.		
١KG	200.E2	outer radius for NKG lat.dens.distr.		
ANG	0.	rotation of array to north		
GI	Т 20. Т Т	longit.distr. & step size & fit & out		
MAP	1.E3	cut on gamma factor for printout		
PRT	100	max. number of printed events		
ECT	<u>·</u> /	output directory		
BAS	T 	write .dbase file		
JUL	TF	write DAT file		
۲	you	user		
JG	F 6 F 1000000	debug flag and log.unit for out		
no /n	ionog/consika/consika_6070/nun	terminates input . □		
ne/pierog/corsika/corsika-6970/run : 🗌				

#### CORSIKA to be used via standard input (keyboard) or by a steering text file redirected in CORSIKA

- ./corsika6970Linux\_QGSJET\_ gheisha < all-inputs</p>
- 3 Types of controls :
  - shower parameters
  - options parameters
  - output parameters

End steering :

# **Shower Parameters (1)**

<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>T</u> erminal	<u>H</u> elp
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DE

nome/p:	ierog/corsika/corsika-6970/run	: cat all-inputs
JNNR	1	run number
/TNR	1	number of first shower event
SHOW	1	number of showers to generate
MPAR	14	particle type of prim. particle
SLOPE	-2.7	slope of primary energy spectrum
RANGE	1.E3 1.E3	energy range of primary particle
IET AP	20. 20.	range of zenith angle (degree)
ΙP	-180. 180.	range of azimuth angle (degree)
ED	1 0 0	seed for 1. random number sequence
ED	2 0 0	seed for 2. random number sequence
BSLEV	110.E2	observation level (in cm)
XCHI	0.	starting altitude (g/cm**2)
AGNET	20.0 42.8	magnetic field centr. Europe
<b>DFLG</b>	0 0 0 0 0 2	flags hadr.interact.&fragmentation
UTS	0.3 0.3 0.003 0.003	energy cuts for particles
JADDI	Т	additional info for muons
JMULT	Т	muon multiple scattering angle
_MFLG	тт	em. interaction flags (NKG,EGS)
EPFC	1.0	mult. scattering step length fact.
DNKG	200.E2	outer radius for NKG lat.dens.distr
RANG	0.	rotation of array to north
NGI	Т 20. Т Т	longit.distr. & step size & fit & o
	1.E3	cut on gamma factor for printout
XPRT	100	max. number of printed events
RECT	<u>·</u> /	output directory
		write .dbase file
ROUT	TF	write DAT file
SER .	you	user
BUG (IT	F 6 F 1000000	debug flag and log.unit for out terminates input
	ierog/corsika/corsika-6970/run	
ionie/p.		· U

#### EVTNR

- event number of first shower
   NSHOW
   Number of showers to simulate
   PRMPAR
   primary particle
- ERANGE and ESLOPE
  - primary energy

#### THETAP

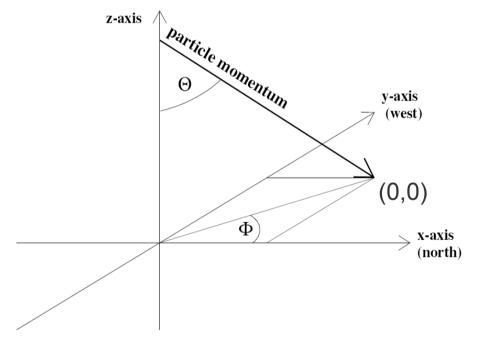
PHIP

ut

 zenith angle (limits depend on CURVED and UPWARD options)

azimuth angle

# **Shower Parameters (1)**



#### EVTNR

event number of first shower

#### NSHOW

Number of showers to simulate

### PRMPAR

- primary particle
- ERANGE and ESLOPE
  - primary energy

#### THETAP

 zenith angle (limits depend on CURVED and UPWARD options)

# PHIP

azimuth angle

#### T. Pierog, KIT - 4/26

# **Shower Parameters (2)**

<u>F</u> ile <u>E</u> dit <u>V</u> iew <u>T</u> erminal <u>H</u> elp	
/home/pierog/corsika/corsika-6970/run : cat all-inputs	
RUNNR 1 run number EVTNR 1 number of first shower event	
EVTNR 1 number of first shower event NSHOW 1 number of showers to generate	- fiv the equipped of random
PRMPAR 14 particle type of prim. particle	fix the sequence of random
ESLOPE -2.7 slope of primary energy spectrum	numbers
ERANGE 1.E3 1.E3 energy range of primary particle	riumpers
THETAP 20. 20. range of zenith angle (degree) PHIP -180. 180. range of azimuth angle (degree)	
SEED 1 0 0 seed for 1. random number sequence	each line correspond to a
SEED 2 0 0 seed for 2. random number sequence	
OBSLEV 110.E2 observation level (in cm)	subpart of CORSIKA (min 2)
FIXCHI 0. starting altitude (g/cm**2)	
MAGNET 20.0 42.8 magnetic field centr. Europe HADFLG 0 0 0 0 0 2 flags hadr.interact.&fragmentation	
ECUTS 0.3 0.3 0.003 0.003 energy cuts for particles	🔸 1 – Hadron
MUADDI T additional info for muons	
MUMULT T muon multiple scattering angle	✤ 2 – EGS4 (e/m)
ELMFLG T T em. interaction flags (NKG,EGS) STEPFC 1.0 mult. scattering step length fact.	
RADNKG 200.E2 outer radius for NKG lat.dens.distr.	🔶 3 – Cherenkov
ARRANG 0. rotation of array to north	
LONGI T 20. T T longit.distr. & step size & fit & out	🔶 4 – IACT
ECTMAP 1.E3 cut on gamma factor for printout MAXPRT 100 max. number of printed events	
DIRECT ./ output directory	🗢 5 – HERWIG
DATBAS T write .dbase file	
PAROUT T F write DAT file	OBSLEV
USER you user DEBUG F 6 F 1000000 debug flag and log.unit for out	
EXIT terminates input	observation level in cm
/home/pierog/corsika/corsika-6970/run :	
	*

1 line / level (up to 10)

# **Shower Parameters (3)**

Tue Te		
/home/pi	ierog/corsika/corsika-6970/run	: cat a
RUNNR	1	run ni
EVTNR	1	numbe
NSHOW	1	numbe
PRMPAR	14	parti
ESLOPE	-2.7	slope
ERANGE	1.E3 1.E3	energy
THETAP	20. 20.	range
PHIP	-180. 180.	range
SEED	1 0 0	seed <sup>.</sup>
SEED	2 0 0	seed <sup>.</sup>
OBSLEV	110.E2	observ
FIXCHI	0.	start:
MAGNET	20.0 42.8	magne <sup>.</sup>
HADFLG	0 0 0 0 0 2	flags
ECUTS	0.3 0.3 0.003 0.003	energy
MUADDI	Т	addit:
MUMULT	Т	muon i
ELMFLG	тт	em.in
STEPFC	1.0	mult.
RADNKG	200.E2	outer
ARRANG	0.	rotat:
LONGI	Т 20. Т Т	longi
ECTMAP	1.E3	cut or
MAXPRT	100	max. n
DIRECT	./	outpu <sup>.</sup>
DATBAS	Т	write

File Edit View Terminal Help

all-inputs umber of first shower event of showers to generate cle type of prim. particle of primary energy spectrum range of primary particle of zenith angle (degree) of azimuth angle (degree) for 1. random number sequence for 2. random number sequence vation level (in cm) ing altitude (g/cm\*\*2) tic field centr. Europe hadr.interact.&fragmentation / cuts for particles ional info for muons multiple scattering angle nteraction flags (NKG,EGS) scattering step length fact. radius for NKG lat.dens.distr. ion of array to north t.distr. & step size & fit & out gamma factor for printout number of printed events directory .dbase file write DAT file user debug flag and log.unit for out terminates input /home/pierog/corsika/corsika-6970/run :

#### FIXCHI (g/cm<sup>2</sup>)

- starting point of shower primary
- not effective if FIXHEI is used

# MAGNET

magnetic field

## HADFLG

- first 5 numbers related to HDPM
- last fix the nuclear fragmentation
  - 0 None
  - 🔶 1 Full
  - 2 or more Realistic

PAROUT T F you

DEBUG

EXIT

F 6 F 1000000

# **Shower Parameters (4)**

<u>F</u> ile	<u>E</u> dıt	<u>V</u> iew	<u>T</u> erminal	<u>H</u> elp
home	/pie	roa/ca	orsika/co	rsika-0

-180

you F 6

/home/pierog,

EXIT

/corsika/corsika-6970/run	: cat all-inputs
	run number
	number of first shower event
	number of showers to generate
	particle type of prim. particle
	slope of primary energy spectrum
1.E3	energy range of primary particle
20.	range of zenith angle (degree)
. 180.	range of azimuth angle (degree)
0 0	seed for 1. random number sequence
0 0	seed for 2. random number sequence
Ξ2	observation level (in cm)
	starting altitude (g/cm**2)
42.8	magnetic field centr. Europe
0 0 0 2	flags hadr.interact.&fragmentation
0.3 0.003 0.003	energy cuts for particles additional info for muons
	muon multiple scattering angle
г	em. interaction flags (NKG,EGS)
1	mult. scattering step length fact.
Ξ2	outer radius for NKG lat.dens.distr.
	rotation of array to north
э. т т	longit.distr. & step size & fit & out
	cut on gamma factor for printout
	max. number of printed events
	output directory
	write .dbase file
	write DAT file
	user
F 1000000	debug flag and log.unit for out
	terminates input
/corsika/corsika-6970/run	: []

#### ECUTS

 lower kinetic energy of particle in GeV

#### MUADDI

 additional informations on muon mother particle

#### MUMULT

- muon multiple scattering type
  - F Gauss approx.
  - T Moliere's theory

# **Shower Parameters (5)**

<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	Terminal	<u>H</u> elp
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home/pierog/corsika/corsika-6970/run : cat all-inputs				
UNNR 1	run number			
VTNR 1	number of first shower event			
SHOW 1	number of showers to generate			
RMPAR 14	particle type of prim. particle			
SLOPE -2.7	slope of primary energy spectrum			
RANGE 1.E3 1.E3	energy range of primary particle			
HETAP 20. 20.	range of zenith angle (degree)			
HIP -180. 180.	range of azimuth angle (degree)			
EED 1 0 0	seed for 1. random number sequence			
EED 2 0 0	seed for 2. random number sequence			
BSLEV 110.E2	observation level (in cm)			
IXCHI 0.	starting altitude (g/cm**2)			
AGNET 20.0 42.8	magnetic field centr. Europe			
ADFLG 0 0 0 0 0 2	flags hadr.interact.&fragmentation			
СИТЅ 0.3 0.3 0.003 0.003	energy cuts for particles			
UADDI T	additional info for muons			
UMULT T	muon multiple scattering angle			
LMFLG T T	em. interaction flags (NKG,EGS)			
TEPFC 1.0	mult. scattering step length fact.			
ADNKG 200.E2	outer radius for NKG lat.dens.distr.			
RRANG 0.	rotation of array to north			
ONGI T 20. T T	longit.distr. & step size & fit & out			
CTMAP 1.E3	cut on gamma factor for printout			
AXPRT 100	max. number of printed events			
IRECT ./	output directory			
ATBAS T	write .dbase file			
AROUT TE	write DAT file			
SER you	user			
EBUG F 6 F 1000000	debug flag and log.unit for out			
XIT	terminates input			
home/pierog/corsika/corsika-6970/run :				

ELMFLG

- NKG : approximation for LDF
- EGS : real MC for e/m particles

## STEPFC

 electron multiple scattering length factor : better not to change

#### RADNKG

maximum radius for NKG LDF

## ARRANG

- rotation of frame at observation level
  - x-axis do not point to North

# **Options Parameters**

All compilation options have their corresponding steering options ... most important ones :

or

# **Output Types**

4 different types of output files :

- Control output (text file)
- Particle list (binary files)
  - DAT file for secondary particles of shower
  - CER file for Cherenkov photons
- Histograms
  - ANAHIST (CERNLIB)
  - AUGERHIST (CERNLIB)
  - First Interaction (CERNLIB)
  - COAST (ROOT) (see R. Ulrich talk)
- Infos on shower production
  - DBASE
  - INFO (Auger)

# **Control Output**

#### Text appearing on screen during CORSIKA runs

- Can be saved in a text file using the ">" sign
  - ./corsika6970 < all-inputs > output.txt
- Content all input parameters, how they are used and general informations on simulated showers
  - 🔸 time
  - number of particles and interactions
  - distributions (longitudinal, energy, ...) per shower and/or averaged
- Should be used to control if all parameters are correct (please sent it in case of problem during simulation)
- Part of the content can be controlled by steering file

#### **Output Parameters : screen**

File Edit View Terminal Help /home/pierog/corsika/corsika-6970/run : cat all-inputs RUNNR EVTNR NSHOW RMPAR 14 ESLOPE -2.7 1.E3 1.E3 ERANGE 20. 20. THETAP PHIP -180. 180. SEED DBSLEV 110.E2 FIXCHI 0. MAGNET 20.0 42.8 HADFLG 0 0 0 0 0 2 0.3 0.3 0.003 0.003 ECUTS MUADDI MUMULT T ELMFLG T T STEPFC 1.0 RADNKG 200.E2 ARRANG 0. T 20. T T LONGI ECTMAP 1.E3 MAXPRT 100 DIRECT DATBAS PAROUT T F USER you F 6 F 1000000 DEBUG EXIT /home/pierog/corsika/corsika-6970/run :

run number number of first shower event number of showers to generate particle type of prim. particle slope of primary energy spectrum energy range of primary particle range of zenith angle (degree) range of azimuth angle (degree) seed for 1. random number sequence seed for 2. random number sequence observation level (in cm) starting altitude (g/cm\*\*2) magnetic field centr. Europe flags hadr.interact.&fragmentation energy cuts for particles additional info for muons muon multiple scattering angle em. interaction flags (NKG,EGS) mult. scattering step length fact. outer radius for NKG lat.dens.distr. rotation of array to north longit.distr. & step size & fit & out cut on gamma factor for printout max. number of printed events output directory write .dbase file write DAT file user debug flag and log.unit for out terminates input

#### ECTMAP

printout option (for check)
 MAXPRT
 detailed printout on screen
 DEBUG

switch on/off debug output

# **Output Parameters : files (1)**

<u>File Edit View T</u>erminal <u>H</u>elp

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D: Di Pi U:

home/p:	home/pierog/corsika/corsika-6970/run : cat all-inputs				
NNR	1	run number			
VTNR	1	number of first shower event			
ISHOW	1	number of showers to generate			
RMPAR	14	particle type of prim. particle			
SLOPE	-2.7	slope of primary energy spectrum			
RANGE	1.E3 1.E3	energy range of primary particle			
HETAP	20. 20.	range of zenith angle (degree)			
HIP	-180. 180.	range of azimuth angle (degree)			
EED	1 0 0	seed for 1. random number sequence			
EED	2 0 0	seed for 2. random number sequence			
BSLEV	110.E2	observation level (in cm)			
IXCHI	0.	starting altitude (g/cm**2)			
1AGNET	20.0 42.8	magnetic field centr. Europe			
IADFLG	0 0 0 0 0 2	flags hadr.interact.&fragmentation			
curs	0.3 0.3 0.003 0.003	energy cuts for particles			
IUADDI	т	additional info for muons			
IUMULT	Т	muon multiple scattering angle			
LMFLG	тт	em. interaction flags (NKG,EGS)			
TEPFC	1.0	mult. scattering step length fact.			
ADNKG	200.E2	outer radius for NKG lat.dens.distr.			
RRANG	0.	rotation of array to north			
.ONGI	т 20. т т	longit.distr. & step size & fit & out			
CTMAP	1.E3	cut on gamma factor for printout			
1AXPRT	100	max. number of printed events			
IRECT	./	output directory			
ATBAS	Т	write .dbase file			
AROUT	TF	write DAT file			
ISER	you	user			
EBUG XIT	F 6 F 1000000	debug flag and log.unit for out terminates input			
home/pierog/corsika/corsika-6970/run : []					

#### RUNNR

 identification of run number (number in all output file names)

#### DIRECT

- path for output files
- /dev/null suppress
   output
  USER / HOST
  - user and host name for identification in .log or .dbase files

# **Output Parameters : files (2)**

<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>T</u> erminal	<u>H</u> elp
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/home/pierog/corsika/corsika-6970/run : cat all-inputs				
RUNNR	1	run number		
EVTNR	1	number of first shower event		
VSHOW	1	number of showers to generate		
PRMPAR	14	particle type of prim. particle		
ESLOPE	-2.7	slope of primary energy spectrum		
ERANGE	1.E3 1.E3	energy range of primary particle		
[HET AP	20. 20.	range of zenith angle (degree)		
PHIP	-180. 180.	range of azimuth angle (degree)		
SEED	1 0 0	seed for 1. random number sequence		
SEED	2 0 0	seed for 2. random number sequence		
	110.E2	observation level (in cm)		
=IXCHI		starting altitude (g/cm**2)		
MAGNET	20.0 42.8	magnetic field centr. Europe		
HADFLG	0 0 0 0 0 2	flags hadr.interact.&fragmentation		
ECUTS	0.3 0.3 0.003 0.003	energy cuts for particles		
MUADDI	т	additional info for muons		
	Т	muon multiple scattering angle		
ELMFLG	тт	em. interaction flags (NKG,EGS)		
	1.0	mult. scattering step length fact.		
RADNKG	200.E2	outer radius for NKG lat.dens.distr.		
ARRANG	0.	rotation of array to north		
	Т 20. Т Т	longit.distr. & step size & fit & out		
ECTMAP	1.E3	cut on gamma factor for printout		
MAXPRT	100	max. number of printed events		
DIRECT	<u>;</u> /	output directory		
	T T F	write .dbase file write DAT file		
JSER DEBUG	you F 6 F 1000000	user debug flag and log.unit for out		
EXIT	F 8 F 1000000	terminates input		
	ierog/corsika/corsika-6970/run			
nolle/p.		· U		

#### LONGI

- switch on/off longitudinal profile and fit
- last flag for extra .long file

#### PAROUT

- switch on/off DATnnnnn file
- switch on/off .tab file

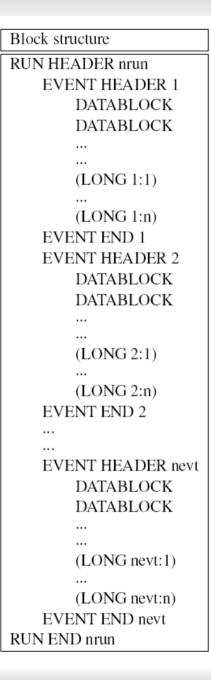
#### DATBAS

switch on/off .dbase or .info
file

## (CERFIL

switch on/off CERnnnnn file)

# **Structure of Binary Files**



## Normal or Cherenkov output files without(with) THIN

- information stored unformatted in a fixed block structure
  - block length = 22932(26208) bytes
  - 1 block = 5733(6552) words (4 bytes)
    - = 21 sub-blocks of 273(312) words
  - sub-block are
    - RUN HEADER (273(312) words)
    - EVENT HEADER (273(312) words)
    - DATABLOCK (39\*7(8) words)
    - LONG (13+26\*10(+39) words)
    - EVENT END (273(312) words)
    - RUN END (273(312) words)
  - if less than n\*21 sub-blocks used, end of block filled with 0
- example to read the files : src/corsikaread.f
  (src/corsikaread\_thin.f)

# **Content of Binary Files (1)**

# Different type of info per sub-block :

Particle data sub-block : (up to 39 particles, 7 words each)		
No. of word	Contents of word (as real numbers R*4)	
$7 \times (n-1) + 1$	particle description encoded as:	
	part. id $\times 1000$ + hadr. generation <sup>76</sup> $\times 10$ + no. of obs. level	
$7 \times (n-1) + 2$	px, momentum in x direction in GeV/c	
$7 \times (n-1) + 3$	py, momentum in y direction in GeV/c	
$7 \times (n-1) + 4$	pz, momentum in -z direction in GeV/c	
$7 \times (n-1) + 5$	x position coordinate in cm	
$7 \times (n-1) + 6$	y position coordinate in cm	
$7 \times (n-1) + 7$	t time since first interaction (or since entrance into atmosphere) <sup>77</sup>	
	in nsec	
	[for additional muon information: z coordinate in cm]	
	for $n = 139$	
	if last block is not completely filled, trailing zeros are added	

Table 9: Structure of particle data sub-block.

Cherenkov photon data sub-block : (up to 39 bunches, 7 words each)		
No. of words	Contents of word (as real numbers R*4)	
$7 \times (n-1) + 1$	number of Cherenkov photons in bunch	
	[in case of output on the particle output file:	
	$99.E5 + 10 \times \text{NINT}(\text{number of Cherenkov photons in bunch}) + 1]$	
$7 \times (n-1) + 2$	x position coordinate in cm	
$7 \times (n-1) + 3$	y position coordinate in cm	
$7 \times (n-1) + 4$	u direction cosine to x axis	
$7 \times (n-1) + 5$	v direction cosine to y axis	
$7 \times (n-1) + 6$	t time since first interaction (or since entrance into atmosphere) <sup>77</sup>	
	in nsec	
$7 \times (n-1) + 7$	height of production of bunch in cm	
	for $n = 1 39$	
	if last block is not completely filled, trailing zeros are added	

Table 10: Structure of Cherenkov photon data sub-block.

# HEADER

general informations (options and primary) on run and events

END

 end of event (including NKG output) and run

# DATABLOCK

- list of particles at observation level
  - id, generation and observation level
  - momentum
  - position
  - time
  - (weight)
- only list of Cherenkov photons in CERnnnnn file

# **Content of Binary Files (2)**

# Longitudinal profile in binary output file

'Longitudinal' sub-block: (up to 26 depth steps/block)		
No. of word	Contents of word (as real numbers R*4)	
1	'LONG'	
2	event number	
3	particle id (particle code or $A \times 100 + Z$ for nuclei)	
4	total energy in GeV	
5	(total number of longitudinal steps)× 100 +	
	number of longitudinal blocks/shower	
6	current number $m$ of longitudinal block	
7	altitude of first interaction in g/cm <sup>2</sup>	
8	zenith angle $\theta$ in radian	
9	azimuth angle $\phi$ in radian	
10	cutoff for hadron kinetic energy in GeV	
11	cutoff for muon kinetic energy in GeV	
12	cutoff for electron kinetic energy in GeV	
13	cutoff for photon energy in GeV	
$10 \times n + 4$	vertical (resp. slant) depth of step $j$ in g/cm <sup>2</sup>	
$10 \times n + 5$	number of $\gamma$ -rays at step $j$	
$10 \times n + 6$	number of $e^+$ particles at step $j$	
$10 \times n + 7$	number of $e^-$ particles at step $j$	
$10 \times n + 8$	number of $\mu^+$ particles at step $j$	
$10 \times n + 9$	number of $\mu^-$ particles at step $j$	
$10 \times n + 10$	number of hadronic particles at step $j$	
$10 \times n + 11$	number of all charged particles at step $j$	
$10 \times n + 12$	number of nuclei <sup>78</sup> at step $j$	
$10 \times n + 13$	number of Cherenkov photons at step $j$	
	for $n = 1,26$ and for j longitudinal steps	
	for $1^{st}$ 'LONG' block: $1 \dots j \dots 26$	
	for 2 <sup>nd</sup> 'LONG' block: 27 j 52	
	for $m^{th}$ 'LONG' block: $(m-1) \cdot 26 + 1 \dots j \dots m \cdot 26$	
	if last block is not completely filled, trailing zeros are added	

# LONG

- only number of particles (no energy deposit)
- for each depth bin, 10 numbers
  - different particle types
- 26 depth bins per sub-block
  - for 20 gr/cm<sup>2</sup> per bin, at least 2 subblocks needed per event
- depth bin = vertical depth
  - use SLANT option to have slant depth

#### Alternative for longitudinal profile

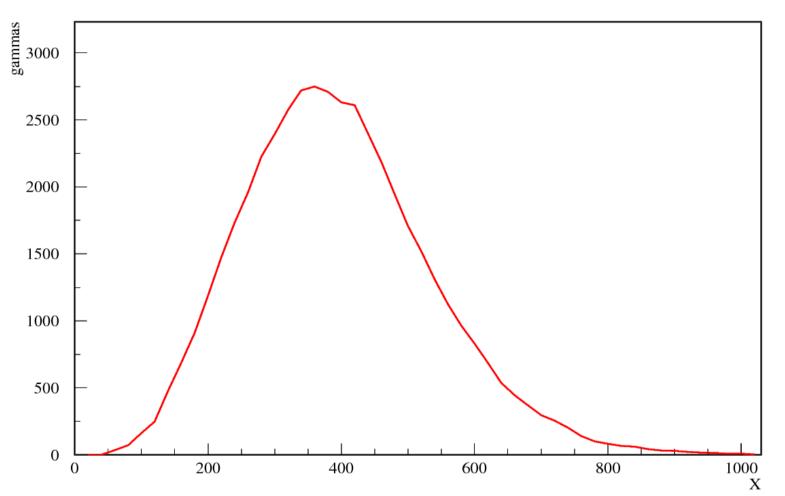
- .long file
  - text file
  - include energy deposit and particle number

# Much More Options ...

Please read the user guide for details and particular options ...

# **Exercice 1**





Plotting can be done by ROOT, PAW, GNUPLOT (plot 'filename' u x:y w 1), ...

#### CORSIKA School Dec 2010

# How to Read DAT file

#### corsikaread (corsikaread\_thin)

C====	
С	
С	CORSIKAREAD (without THINNING)
С	
С	
С	READ AND PRINT CORSIKA SHOWER DATA
С	
С	
С	output format for particle output (blocklength = 22932+8 fixed)
С	each block consists of 21 subblocks of 273 words.
С	How to use this program:
С	1) Generate a file 'input' containing the path and name of the
С	DATnnnnn file to be analyzed by this program.
С	The name should not contain leading blanks but filled up
С	by trailing blanks to get a total length of $>70$ characters.
С	2) Execute this program with the file 'input' as standard input:
С	corsikaread <input/> output
С	3) The file 'output' will contain a short overview of the
С	content of the DATnnnnnn file to be analyzed.
С	4) The file fort.8 will contain a detailed print out of the
С	content of DATnnnnn.
С	
С	D. Heck FZKA, May 14, 2004
C====	

# fort.8 file

# corsikaread translate the DAT file into the fort.8 ASCII file containing all informations

- RUNH identified by 1.11111E+07 followed by 272 floats
  - ✤ 39 lines of 7 numbers in the file
- EVTH identified by 3.33333E+07 followed by 272 floats
  - 39 lines of 7 numbers in the file
- DATABLOCK, each line correspond to one particle
  - id, generation and observation level (1 float)
  - 🔶 momentum (3 floats)
  - position (2 floats)
  - time (1 float)
- LONGBLOCK identified by 5.55555E+07 followed by 272 floats
  - 39 lines of 7 numbers in the file for 26 steps in depth \* (# of steps/26)
- EVTE identified by 7.7778E+07 followed by 272 floats
  - 39 lines of 7 numbers in the file
- RUNE identified by 1.00000E+08 followed by 272 floats
  - 39 lines of 7 numbers in the file

Repeated for each event in run

# **Exercices 2 and 3**

2) Using all-inputs, plot scattering plot of muons at ground.

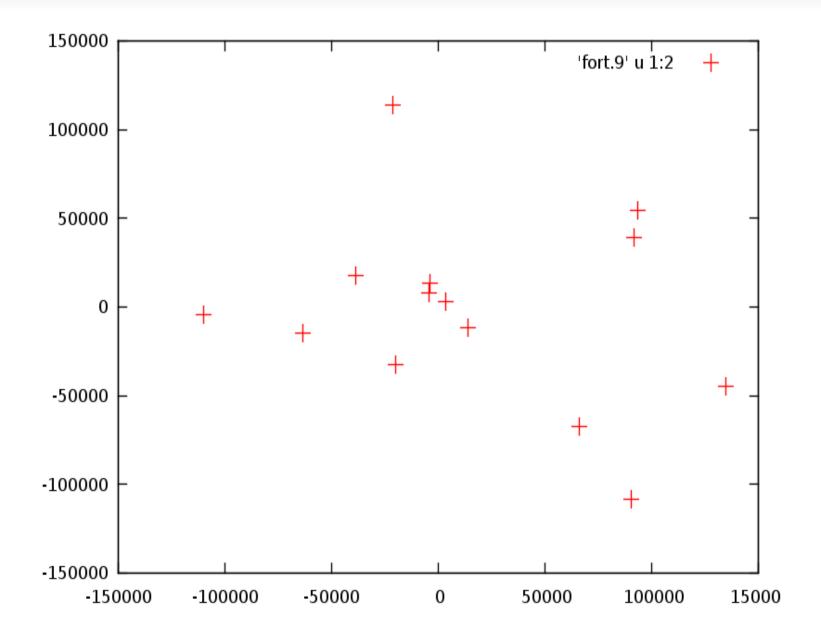
- read fort.8 file
- or change corsikaread to save only needed informations

3) Using all-inputs, plot lateral distribution density of muons

- read fort.8 file and analyse data
- or change corsikaread to save distribution directly

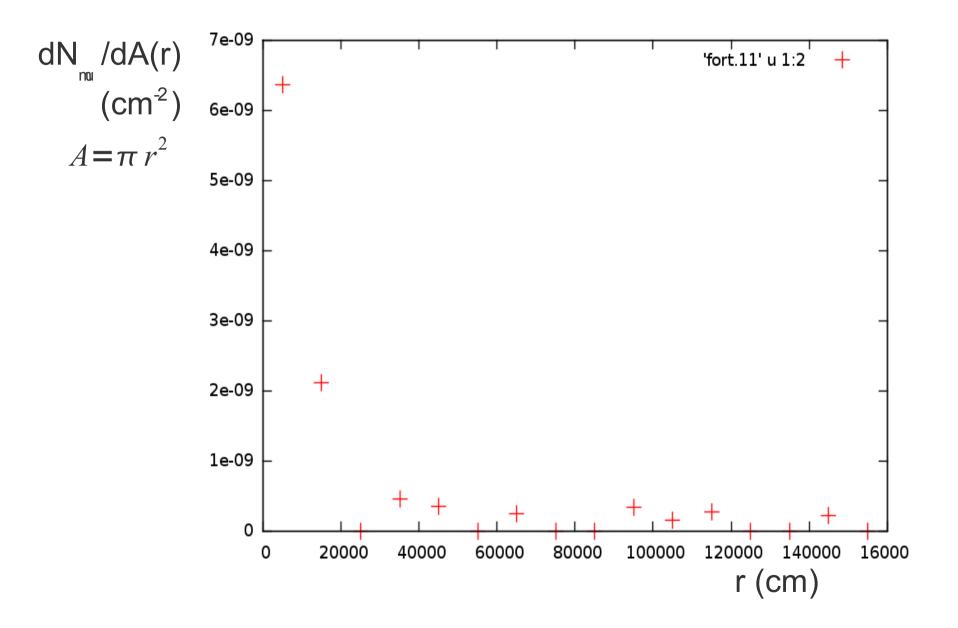
You can recompile corsikaread after modifications simply by using make install in corsika-6970/

# **Result Exercise 2**

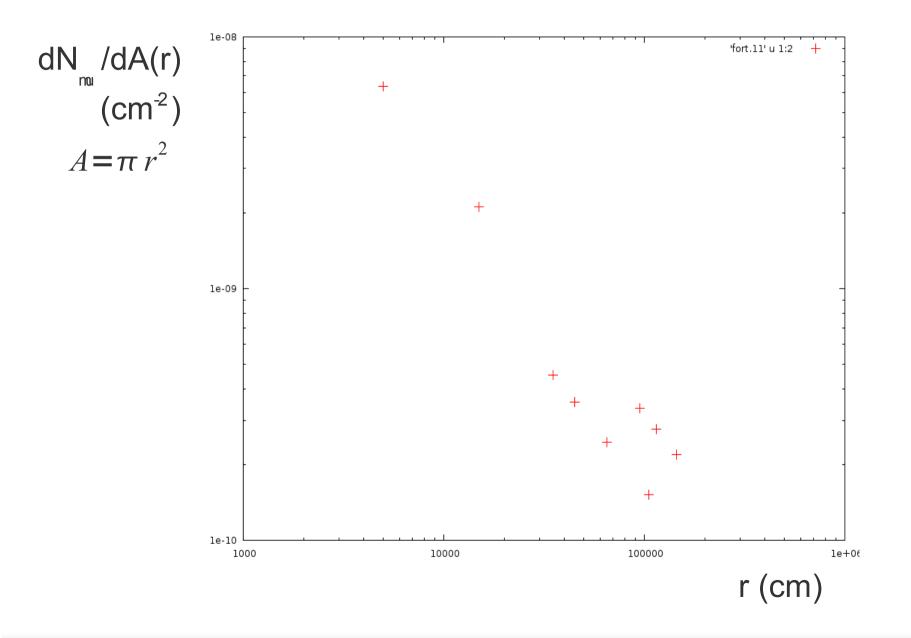


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#### **Result Exercise 3**



## **Result Exercise 3**



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# **Exercise 4**

4) Compile CORSIKA with EPOS and THIN and run eposinputs at 10<sup>15</sup> eV to compare NKG and real particles outputs (longitudinal profile and lateral distribution of electrons).

> epos-inputs has to be changed !